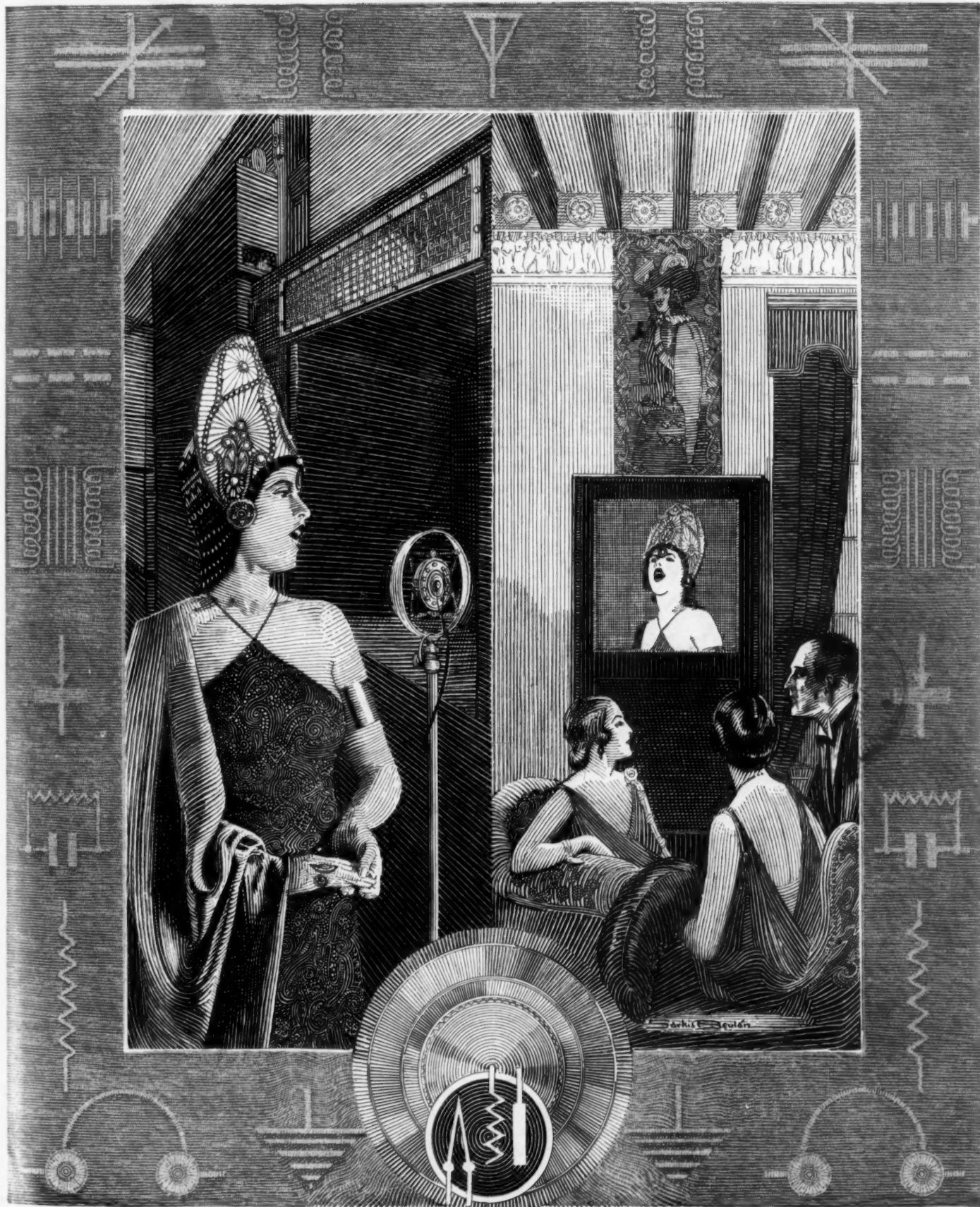


OCTOBER, 1927

25 CENTS

RADIO

(REG. U. S. PATENT OFF.)



IN THIS ISSUE — THE TYRMAN TEN-340 K. C. RECEIVER

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The Advance Guard of Radio

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*Twenty types - all in the
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Boston, Mass., U. S. A.

Est. 1907



Faradon

1241

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Tell them that you saw it in RADIO

RADIO

With Which Is Incorporated "Radio Journal"

Established 1917

Published Monthly by the Pacific Radio Publishing Co.

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Editor

GERALD M. BEST,

Technical Editor

H. W. DICKOW,

Business Manager

A. I. RIVETT,

Draughtsman

Branch Offices:

New York City, 20 East 42nd St.
Chicago, 307 N. Michigan Ave.
Boston, 86 St. Botolph St.
Kansas City, Mo., Davies & Dillon, 707 Land Bank Bldg.

Rates:

Issued Monthly, 25c a copy.
Subscription price, \$2.50 per year
in the U. S., \$3.00 per year elsewhere.

Correct Addresses:

Instructions for change of address
should be sent to the publisher
two weeks before the date they
are to go into effect. Each old
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Advertising:

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Entered as second-class matter at Post Office at San Francisco, Calif.

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Address all communications to

Pacific Radio Publishing Company

Pacific Building, San Francisco, California

VOLUME IX

OCTOBER, 1927

NUMBER 10

CONTENTS

	PAGE
RADIOTORIAL COMMENT	19
RADIO IN THE HONOLULU FLIGHT	20
By Arthur Hobart	
RADIO FROM AN AMPLIFICATION VIEWPOINT	21
By Simpleton Fitts	
THE TYRMAN TEN	22
By E. Tyrman	
HOW TO SERVICE THE INSTALLED SET	25
By B. F. McNamee	
THE MISFIRE	27
By Paul Oard	
CHART FOR FINDING GREAT CIRCLE DISTANCES	28
By W. C. Osterbrock	
SOCKET-POWER OPERATION OF THE MAGNAFORMER	29
By G. M. Best	
THE RADIO GROUND CONNECTION	31
By Charles F. Felstead	
HOW TO TEST RADIOLA CATACOMBS	33
By Edward T. Jones	
SOME NEW NEMA STANDARDS	35
THE EXPERIMENTAL SHOP	36
By Samuel G. McMeen	
AN ELECTRIC PHONOGRAPH PICK-UP	37
By Carl J. Penther	
DIRECT COMMUNICATION	38
By Gilson V. Willets	
ANALYSIS OF R. F. TRANSFORMER PERFORMANCE	39
By Kendall Clough	
QUERIES AND REPLIES	42
AN IMPROVED CAPACITY MICROPHONE	43
By C. K. Stedman	
A 5-METER SUPER-REGENERATIVE RECEIVER	44
By Francis Churchill	
CALIBRATION OF A 5-METER WAVEMETER	45
By A. Binneweg, Jr.	
THE COMMERCIAL BRASSPOUNDER	46
NORTH PACIFIC SCHEDULES	47
By L. O. Doran	
FROM THE RADIO MANUFACTURERS	48
REGULATIONS FOR OPERATORS' LICENSES	79
SCRATCHEE CLEARS THE AIR	84

Forecast of Contributions

for November Issue

"Fishing for Radio Waves" is the subject of an article by Everett W. Thatcher wherein he explains in simple terms the manner of radio propagation and the causes of fading.

— : —

G. M. Best has constructed a heavy duty audio amplifier using 50-watt tubes. It gives fine tone quality at great volume for use in a large hall or outdoors and may also be used with a phone transmitter. He gives full details for building it.

— : —

Donald K. Lippincott discusses the limitations of distortionless audio amplification with special reference to cut-off points.

— : —

Francis Churchill's article on a constant gain receiver, which was unavoidably omitted from the October issue, is scheduled for the November number. For the amateur operator he also describes a six-tube short wave receiver which efficiently covers all the amateur bands except the $\frac{3}{4}$ meter. He uses an autodyne circuit.

— : —

G. F. Lampkin has an unusually helpful article on rectifiers, explaining the theory and comparing the efficiencies of various types used for radio.

— : —

The Radio Service Shop, its location, equipment and testing methods, is discussed by B. F. McNamee. Complete directions are given for making and using a receiver comparison switch.

— : —

Continuing his series of articles on Experimental Shop Practice, Samuel G. McMeen tells how to make a galvanometer and a bug key.

— : —

Adaptation of the Magnaformer set, first described in the September issue, for the use of a. c. filament tubes is fully explained.

— : —

Harry R. Lubcke gives some helpful information on testing resistor values.

— : —

Mickey Doran continues his "North Pacific Schedules" with some hitherto unpublished information on weather codes.

— : —

The fiction feature is a story by Earle Ennis entitled "The Grey Phantom." It combines the radio and airplane in a thrilling defeat of bootlegging attempts.

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Radio Sets
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equipped
for
BATTERY
or
ELECTRIC
Operation



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7 Tubes-1 Dial
\$75.00

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Big Discounts to Agents
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Electric operation

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Easiest set to operate. Only one small knob tunes in all stations. The dial is electrically lighted—easy to log stations, even in the dark. The volume control regulates the reception from a faint whisper to thunderous volume, 1,000 to 3,000 miles on loud speaker! The Metrodyne Super-Seven is a beautiful and efficient receiver, and we are so sure that you will be delighted with it, that we make this liberal 30 days' free trial offer. You to be the judge.

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N. M. Greene, Maywood, Ill., writes: "My time is up and the Metrodyne works fine. I got Havana, Cuba, Oakland, Calif., Denver, Colo., Toronto, Canada, all on the loud speaker."

J. W. Woods, Leadville, Colo., writes: "Received the 7-tube Metrodyne in fine condition. Had it up and working the same day received. Was soon listening to Los Angeles, San Diego, Oakland and other California points; also St. Louis, Kansas City and other east and south stations—all coming in fine. Am more pleased. Sure enjoying it."

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Send me full particulars about Metrodyne 6 tube and 7 tube sets and your 30 days' free trial offer.

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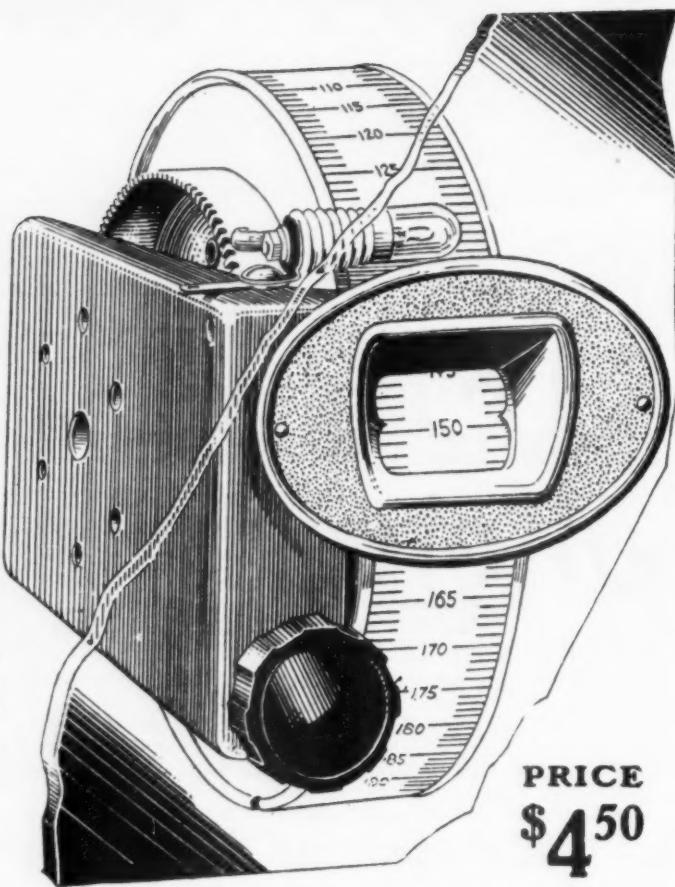
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If you are interested in AGENT'S proposition, place an "X" in the square →

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The immediate acceptance and prestige that the Remler Drum Dial enjoys is due to its design in meeting the requirements of all standard makes of condensers either single or in gangs of one, two or three condensers. It gives a full 15 inches of dial space divided into 200 divisions—two for each broadcast channel. While the calibration strips are rigidly mounted, they can be easily removed and new ones



DIAL

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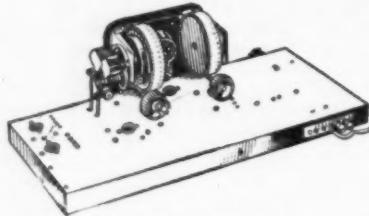
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for the
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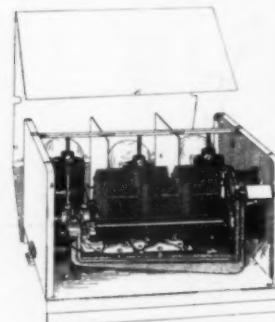
Remler Choke Coil



Remler Infradyne Amplifier



Remler Infradyne Foundation Kit



Remler Radio Frequency Amplifier



Remler Antenna Compensator



Remler Improved Socket

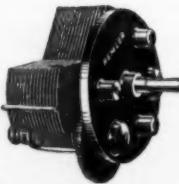
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GRAY & DANIELSON MFG. CO.

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Eastern Warehouse: Elkhart, Ind.

Chicago

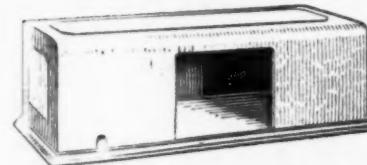
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Remler Three-in-Line Condenser



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HIGH AMPLIFICATION ratio with flat curve . . . High primary inductance maintained under normal operating conditions . . . Low leakage reactance resulting in uniform amplification at high frequencies . . . Primary winding of ample cross section to withstand continuously, plate currents resulting from all usual operating conditions . . . No compound or fibrous material used in construction, therefore low self and mutual capacity with durability and long life . . . Core of specially tested material of ample cross section . . . Primary shunted with built in condenser of correct capacity . . . Every transformer subjected to ten tests to insure uniformity of product . . . Tested to one thousand volts throughout.

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Weight 1 lb. 8 oz.



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FERRANTI A. F. 4 TRANSFORMERS

*Exclusively specified for the
Magnaformer 9-8 Circuit*



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Output Transformers

High efficiency with low leakage inductance and self capacity improves loud speaker results . . . Insulates the loud speaker, preventing accidental contact with high plate voltages required with power tubes . . . Danger of burning out the delicate windings of the loud speaker and of demagnetizing its magnets is eliminated . . . Tested to 1000 volts throughout, therefore . . . Safe for use with highest plate voltages used in high grade radio receiving sets . . . Connect primary to Output of set, secondary to loud speaker.

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Holinwood England

FERRANTI Inc.
130 West 42nd Street, New York, N.Y.
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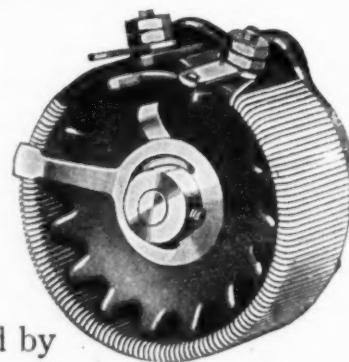
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Toronto, Ontario, Canada

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Exclusively Specified by G. M. Best
for the Powerful Magnaformer Circuit



Insist on these genuine Frost Radio Parts and enjoy the same wonderful results with your Magnaformer.
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 1 Frost DeLuxe 10-ohm combination Rheostat and Filament Switch
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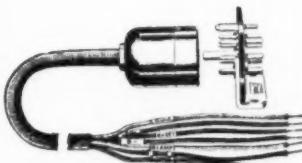
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APPROVED RADIO PRODUCTS

They meet the most exacting requirements of modern radio receiver design and are dependable to the last degree.

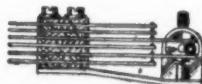
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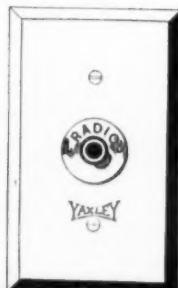


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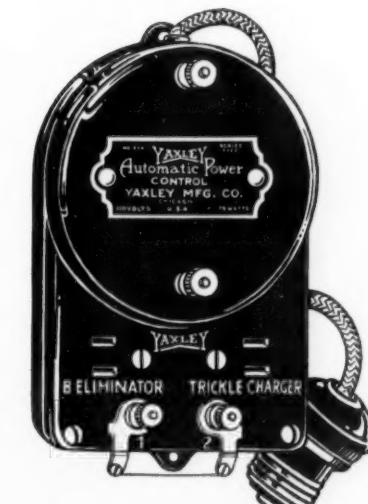


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.....\$1.25

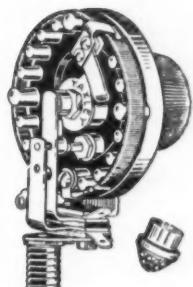


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Air-Cooled Switching Rheostat, all sizes.....\$1.75

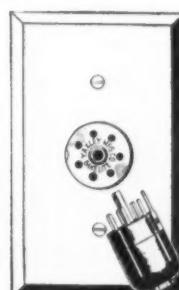
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Resistance Units, with combination screw eye and soldering lug for mounting to panel or soldered connectors.....15c

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TRADE MARK

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Sockets
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are specified for the
**Magnaformer
9-8 Circuit**



Spring Supported
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USED the world over by set builders who know and want the best.

Stop tube noises. Anti-microphonic. The greatest contribution to the non-noisy operation of the set.

Tube "floats" on finely tempered springs. One-piece terminal to tube connection. Knurled nuts for binding post connections or handy lugs for soldering.

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St. James Super
Two-Dial Equamatic

Benjamin Shelf Bracket

An aid to simplification in set construction. Support sub-panel, with room underneath for accessories and wiring. Plain and adjustable.

At all Radio Jobbers and Dealers

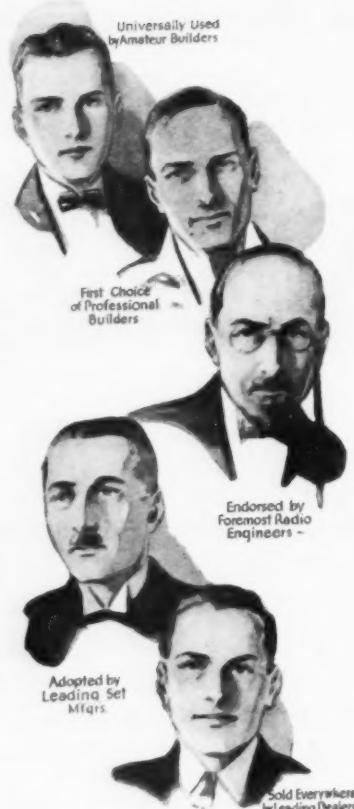
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FIRST CHOICE

*of the Keenest
Minds in Radio!*

Durham Metallized Resistors and Powerohms are the leaders in their field because they have definitely proved their uniform, unfailing accuracy and absolute reliability. This is why they are the first choice of foremost engineers, leading manufacturers, professional set builders and informed radio fans who demand quality results. If you are not using Durhams now, an experiment with replacements should prove why they are the first choice of the keenest minds in radio.



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Quali-Tone

DE LUXE

Exclusively Specified for the
**Magnaformer
9-8 Circuit**



Also recommended for use with the 9-in-Line. World's Record Super, Melo Heald, Victoreen, St. James, Popular Mechanics Economy Nine and many other receivers.

Holds Two World Records for DX Reception

Enjoy your set more with a DeLuxe or Quali-Tone loop. They greatly improve the performance of any loop receiver using .0005 condensers. Far superior to all other antenna for Selectivity—Tone—Appearance. Now you can separate those troublesome stations and bring in DX programs with ease.

The DeLuxe \$12.50
The Quali-Tone 10.00

Jobbers **Dealers**
The Quali-Tone Loop is not an experiment. For two years it has been the fastest selling loop on the market—due entirely to its exceptional merit and the improved results it guarantees. Order today or write for circulars.

DURO METAL PRODUCTS CO.
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Follow It!

ANOTHER story on the Magnaformer 9-8 circuit by Gerald Best in the November issue of "RADIO." You should subscribe now to insure yourself against missing a single issue of "RADIO." Get it for the next 6 months for only one dollar. That's a considerable saving. Use the coupon—attach a dollar bill, money order, check or stamps to it and get it on the way now—before you turn this page.

----- COUPON -----

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Here is \$1.00 for which you will send me the next 6 issues of "RADIO" starting with the November issue.

Name.....

Address.....

City & State.....

Magnaformer

Magna—The dictionary definition of "magna" (Latin) is "great"; the definition of "former" is "creator". Thus, we have the Great Creator, truly a name emblematic of the astonishing accomplishments of the Magnaformer.

Price
\$8.50



Two Years Ahead in Design

At the Radio Trade Show in Chicago, the announcement of the Magnaformer was one of the few startlingly new ideas in radio development. We know from actual observation that the Magnaformer is two years ahead in design, for it incorporates advanced and evolutionary ideas throughout. It is distinctly different, with its self-shielding, matched units, double amplification for each R. F. stage and excellent laboratory construction. It is a fresh idea—the very heart of the new and better receiver in which its remarkable qualities are given full range. Coming, as it does, when the air has been cleared by the new rulings of the federal radio commission, it makes it possible to secure exceptional results, accomplishments heretofore unknown to radio fans.

The Great Creator of True Tone Quality

The Magnaformer 9-8 circuit—Commander-in-Chief of the air—now being featured in complete constructional articles by G. M. Best in *RADIO*, by L. M. Cockaday in *Popular Radio* and by the Chief Technical Editor in *Citizens Radio Call Book* and in numerous other magazines and newspapers—is two years ahead of the field in new, True-Tone Quality creating improvements. Be sure to read these constructional articles written by the foremost radio authorities. A

Magnaformer 9-8 set possesses a fidelity and purity of tone that is actually marvelous. Mere words cannot define nor describe it. Only the ear itself can understand and appreciate its full, clear, natural sweetness. Women, musicians and experts—especially—are enthusiastic in their praise of the tone quality of the Magnaformer 9-8, for it represents the dawn of a new and far greater satisfaction in radio reception.

Advanced Electrical Design — Absolute Mechanical Precision

The "soul" of any radio set is its tone quality. "For what shall it profit a man if he gain the whole world and lose his own soul." Likewise—what do we gain if our radio sets have the finest cabinets, the best speakers, batteries, tubes, aerials, etc., if they have no "soul"—if they lack True Tone Quality?

The most magnificent performance any radio will ever give is faithfully to reproduce the output of the broadcasting stations. This the Magnaformer 9-8 does very nearly to perfection. The difference between the tone quality of the Magnaformer 9-8 and ordinary radio sets—no matter how good looking or expensive—is the difference between the tone quality of an ordinary piano and a Steinway—the difference between the tone quality of the voice of a cheap vaudeville singer and the voice of a Caruso or a McCormack—the difference between the tone quality of the ordinary, old style phonograph and the new Orthophonic Victrola.

The tone of a cheap piano is disappointing to those who have had the pleasure of listening to a Steinway. The tone of an ordinary radio set is equally unsatisfactory to the ears of all those who have ever heard the beautifully natural tones pour forth from a Magnaformer 9-8. Build a Magnaformer 9-8 for yourself or have one built for you and you will experience the supreme satisfaction of possessing the very choicest and most accurate reproducer of radio broadcasting possible to construct.

The thunderous tones of a mighty organ—the full, rich, resonant tones of the opera singer—the soft, appealing tones of the violin—the plaintive tones of the flute or piccolo—the perfect, individual tones of each musical instrument in a 100-piece orchestra—every iota of tone shading of the entire range of the human voice, from the lowest bass to the highest soprano and from the softest whisper or Pianissimo to the most massive Double Forte—all of these are FAITHFULLY reproduced by the Magnaformer 9-8. So clearly, distinctly and truly is every minute detail of the most elaborate and varied broadcast program reproduced by the Magnaformer 9-8 that you must marvel at its degree of perfection.

The advance electrical design and absolute mechanical precision of Magnaformer Long Wave Radio Frequency Transformers accounts for the marvelously true tone quality of the Magnaformer 9-8 receiver. These R. F. Transformers are strictly a laboratory product—the result of a great many experiments and tests extending over a long period of time. The object of these tests and experiments was to develop and perfect, if possible, a very superior precision instrument that could be duplicated by the thousands—each and every duplicate having EXACTLY the same characteristics as the master coil itself.

These tests and experiments have eventually, after a long period of time, proved highly SUCCESSFUL. Each Magnaformer is to all intents and purposes EXACTLY like every other Magnaformer. Only by the employment of elaborate laboratory apparatus can even the expert technician discover a difference. It is this EXACT matching of Magnaformers—and building them so carefully and mechanically perfect that they stay EXACTLY MATCHED under all sorts of conditions that insures the exclusive degree of True Tone Quality that the Magnaformer 9-8 possesses.

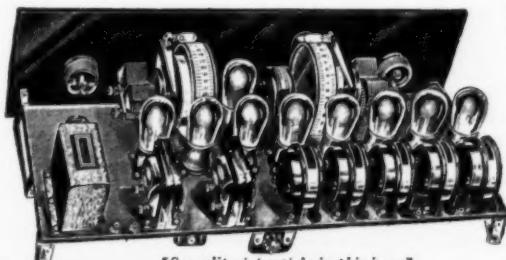
The Magnaformer 9-8, being an extremely powerful multi-tube receiver, the incoming Radio High Frequency signal must necessarily pass through several amplifying stages before it reaches the detector. If each and every Long Wave R. F. Transformer that is connected to each and every tube in each and every stage of the R. F. section of the receiver is not to all intents and purposes EXACTLY like each and every other Transformer in the set in electrical characteristics, it is absolutely impossible to secure True Tone Quality.

Every Magnaformer is peaked to a certain definite wave length. This peaking is all done in the laboratory by thoroughly trained experts. Each and every Magnaformer can pass ONLY the same identical length of wave. Therefore, the full and complete wave-band with 100% of its vital, quality-producing harmonic-carrying side-bands, is positively and easily passed through all of the Radio Frequency amplifying stages. This extraordinary performance of Magnaformer naturally results in as nearly true tone quality as is possible to achieve. And in no other manner can True Tone Quality be achieved.

After Magnaformers are precisely peaked—every one alike—they are permanently sealed so that there can be not the slightest possibility of any change of wavelength at which they are peaked. They cannot be affected by moisture, dust, change of climate, age or jarring. They are so carefully and rigidly constructed mechanically as to preclude any possibility of change of electrical characteristics.

Naturally, the Magnaformer 9-8, besides possessing the very highest tone quality, also possesses in equally high degree the other three qualities necessary in a first-class receiver—selectivity, volume and distance-getting ability. On account of the precise exactness of the electrical factors of Magnaformers, the set is exceptionally selective, although not critically so. Stations are easily tuned in or out at will without having to be located by a micrometer adjustment of the dials as is the case with sets whose long wave transformers are not EXACT. Magnaformers were also designed to give the greatest possible amplification per stage. You will find that Magnaformers give nearly double amplification per stage. It is seldom every necessary to use the entire 9 tubes—8 tubes give a world of volume even on distant stations. You will use 9 tubes only on very distant or very weak signals. The switching from eight to nine tubes and from nine to eight tubes is done instantly by means of a convenient little switch located on the front panel. The precise matching of the Magnaformer Transformers and their great amplifying power naturally makes the Magnaformer 9-8 hyper-sensitive to even very weak signals that would be absolutely impossible of reception on ordinary sets. Probably no other type of set can log as many distant stations of an evening as can easily be brought in on a Magnaformer 9-8. The Magnaformer certainly hasn't a peer in great distance-getting ability.

Everyone now has the opportunity to enjoy the Magnaformer's exceptional performance. You can be one of the very first to build it and to enjoy its superb tone quality. After you once hear it you will appreciate why it is called Magnaformer—The Great Creator of True Tone Quality. You are privileged to secure all the facts. You are more than welcome to them. If you will merely mail the coupon below we will gladly send you complete Magnaformer 9-8 literature. Write today—surely.



[See editorial article in this issue]

RADIART LABORATORIES CO., 19 S. La Salle, Dept. 87, Chicago

Dear Sirs: Please send me your complimentary descriptive literature on the Magnaformer 9-8 receiver containing facts regarding its remarkable performance and true tone quality.

Your Name.....
Address.....
City.....
State.....

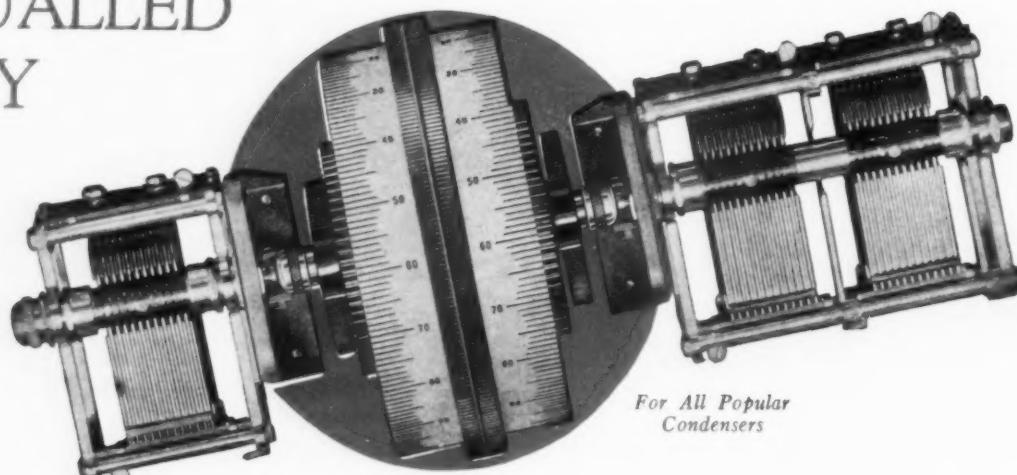
Radiart Laboratories Co. 19 S. LaSalle St., Dept. 87
CHICAGO, ILLINOIS

TYRMAN

Assure Efficiency ~ Accuracy

UNEQUALLED
BEAUTY

LABORATORY
TESTED



TYRMAN VERNIER DRUM For All Fine Receivers

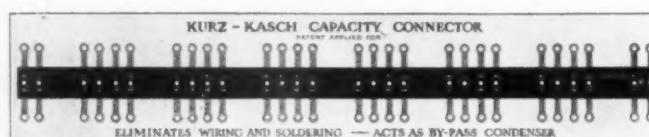
SPECIFIED

All Tyrman Products are highly praised and recommended by every leading Radio Engineer. Citizens Radio Call Book specifies Tyrman Parts for use in the Improved Remler 45 K. C. Superheterodyne, the Camfield Duoformer 7, and the Tyrman "10" Receiver. Read construction article on Tyrman "10" in this issue.

Recognized by leading Radio manufacturers and engineers as the most perfect tuning device on the market. It is a new and most artistically designed instrument that assures a vastly improved performance and a beauty of appearance hitherto unknown. A high grade bronze escutcheon encloses the drums and verniers. It combines direct and vernier tuning, with the smoothest action ever obtained in such devices. Graduations are silver etched with raised lines and figures. New clutch arrangement guarantees perfect concentricity of drums and condenser shafts. Vernier held in steady contact with the drum by a flexible spring balanced bearing. Mounting holes for all popular condensers are provided. The beautiful Tyrman Vernier Drum will improve the looks of any receiver.

Single control unit Price—\$ 5.00
Double control unit 10.00

Kurz-Kasch Capacity Connector



The Kurz-Kasch Capacity Connector is an entirely new patented device offered to the public for the first time through the TYRMAN ELECTRIC CORPORATION, Exclusive Distributors. This new development eliminates 90% of wiring and acts as a by-pass condenser between all battery leads. It conforms to the best engineering requirements and is highly praised and recommended by the leading engineers of the country.

Price \$7.50

TYRMAN ELECTRIC CORP.

PRODUCTS

-Simplicity



TYRMAN T. R. F. TRANSFORMERS

Have made the name "Tyrman" predominant in the Radio World. These transformers are recommended where more amplification, better selectivity, and superior physical qualities are desired:

Type 8-70 T.R.F. 200 to 550 meters with .00035 condensers Price—\$4

Type 8-71 T.R.F. 160 to 360 meters with .00035 condensers 4

Type 8-80 T.R.F. Transformer 882 meters 7

Tyrman T.R.F. Transformers are designed for terminals of the Kurz-Kasch Capacity Connector.

THE TYRMAN SHIELDED SOCKET

Is the first practical and successful design of its kind. Assures proper functioning of each tube under the influence of both static and magnetic fields. Shielding is of heavy aluminum—the best heat conductor obtainable, which radiates uniformly and keeps tube temperature constant. Constructed to allow baseboard mounting or subpanel wiring.

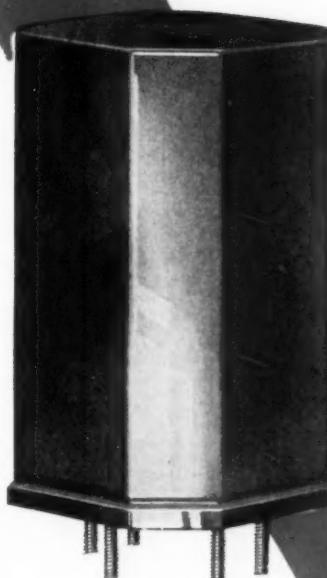
Price..... \$1.25

TYRMAN AUDIO TRANSFORMERS

Designed by Ernst Tyrman to improve reproduction in powerful receivers. They represent a masterpiece of acoustic engineering. Never before has the bass note amplification been accomplished so successfully. The combination of three units is recommended where greatest volume is to be obtained with most faithful reproduction. Complete information on electrical details furnished upon request.

Type 3-30 3:1 ratio Trans-	former	\$ 8.00
Type 3-50 Power Input	Transformer	10.00
Type 3-51 Power Output	Transformer	10.00

Tyrman Audio Transformers are designed for the terminals of the Kurz-Kasch Capacity Connector.



JOBBERS—DEALERS

TYRMAN Products all carry an unconditional guarantee of Excellence. They are indeed—Radio's Finest—added to this they are already well-known and extremely popular. A comprehensive, national advertising campaign will assure their continued favor. Get T E C Products. You will find them most profitable. Write us for further particulars.



SET BUILDERS Mail This Coupon

TYRMAN ELECTRIC CORP.
141-143 W. Austin Avenue
Chicago, Illinois

Gentlemen:

Kindly send me, gratis, special information describing T E C Products in detail.

Place my name on your mailing list to receive advance information of new developments in your laboratory.

Name.....

Address.....

State.....

Jobber's Name.....

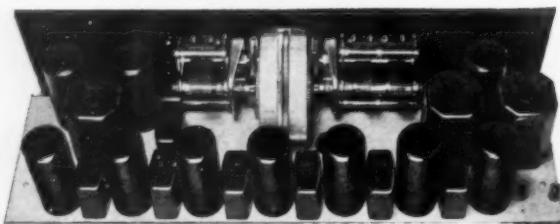
Address.....

141 West Austin Avenue, CHICAGO

Tell them that you saw it in RADIO



Winning the Country by Performance!



LIST OF PARTS FOR TYRMAN TEN

	Price
2 Tyrman Type 8-70 R.F. Transformers	\$8.00
1 Tyrman Type 8-71 R.F. Transformer	4.00
4 Tyrman Type 8-80 R.F. Transformers	28.00
1 Tyrman Type 3-30 Audio Transformer	8.00
1 Tyrman Type 3-50 Power Input Transformer	10.00
1 Tyrman Type 3-51 Power Output Transformer	10.00
1 Tyrman Vernier Drum, Double	10.00
10 Tyrman Shielded Sockets	12.50
1 Kura-Kasch Capacity Connector	7.50
1 7x26 Front Panel Drilled and Decorated	6.50
1 7x26 Sub-Panel Ivory Bakelite	6.20
2 Benjamin Brackets	.70
2 Carter 1 mfd. Condensers	2.50
1 Carter $\frac{1}{2}$ mfd. Condenser	.90
1 Carter .00025 Mica Condenser	.50
1 Carter .001 Mica Condenser	.50
1 Yaxley No. 669 Cable Connector, Comp.	3.25
1 Daven 3 meg. Resistance with mounting	1.00
1 Yaxley Filament Resistance 1 $\frac{1}{2}$ amp. 5 volts	.15
1 Yaxley Filament Resistance 1 $\frac{1}{4}$ amp. 5 volts	.15
1 Yaxley 25 ohm Rheostat with Switch	1.75
1 Yaxley 200 ohm Potentiometer	1.75
2 Chelten 45 mf. Midget Condensers	1.50
2 Chelten Binding Posts, Ant. and Ground	.30
Hardware: 10 lengths bus bar, 3 lengths spaghetti, 100 Kellog Lugs	1.30
1 Camfield .00035 Condenser No. 351	5.75
1 Camfield .00035 Two-Gang Condenser No. 352	10.50
1 Yaxley No. 7200 Grid Resistance	.25
	\$143.85

The Choice of All America!

1928 Latest Creation!

TYRMAN TEN!

Build as Specified by
Tyrman Laboratories

The correct hook-up is shown in this Big, Beautiful, Money-Saving Catalog. Describes everything new and desired in radio—all under our roof. Complete stock carried.



CATALOG FREE

TELEPHONE MAINTENANCE CO.

123-K S. WELLS STREET

CHICAGO, ILL.

Chicago's Oldest Radio House

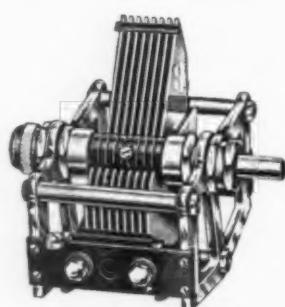
Camfield

Equaltune Condensers

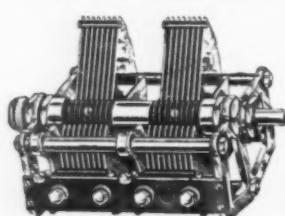
Specified for the Tyrman Ten

THE following features of the Camfield Equaltune Condensers are not to be found in any other one Condenser on the market:

1. To facilitate sharp tuning and perfect balancing in sets of the unit control type, the Camfield Equaltune Condensers are provided with a special adjustment feature which makes possible the perfect equalization of all circuits after the receiver has been completely wired. This eliminates the necessity for using Vernier or trimmer condensers of any kind. Complete instructions and a special tool for making this adjustment are packed with each double and three-gang condenser.
2. The shaft may be shortened or lengthened or entirely removed without affecting the adjustment of the rotor plates. This provides a simple means for connecting several units together with a single shaft and anywhere from one to six condenser units may be operated with one dial.
3. The Condenser is so designed that it may be mounted from either end. This is accomplished by reversing the shaft cap nut and the panel mounting nut. After the shaft cap nut has been removed the shaft may be extended from the opposite end of the condenser by loosening the set screws on the rotor hub.
4. A variable spring tension is provided and the rotor is mounted on ball bearings which insure extremely smooth running over a long period of operation.
5. Camfield Equaltune Condensers are beautifully finished. The rotor and stator plates are of bright dipped brass. All other parts are hand buffed and nickel plated.
6. A pair of special brackets for mounting the condensers on a base-board or sub-panel can be obtained at a slight additional cost. With the use of these brackets several single condensers may be mounted in a row on a base-board or sub-panel and all operated with a single shaft.



Type 351 (Single)
Capacity .00035—Price \$5.75



Type 352 (Two Gang)
Capacity .00035—Price \$10.50

CAMFIELD RADIO MANUFACTURING COMPANY

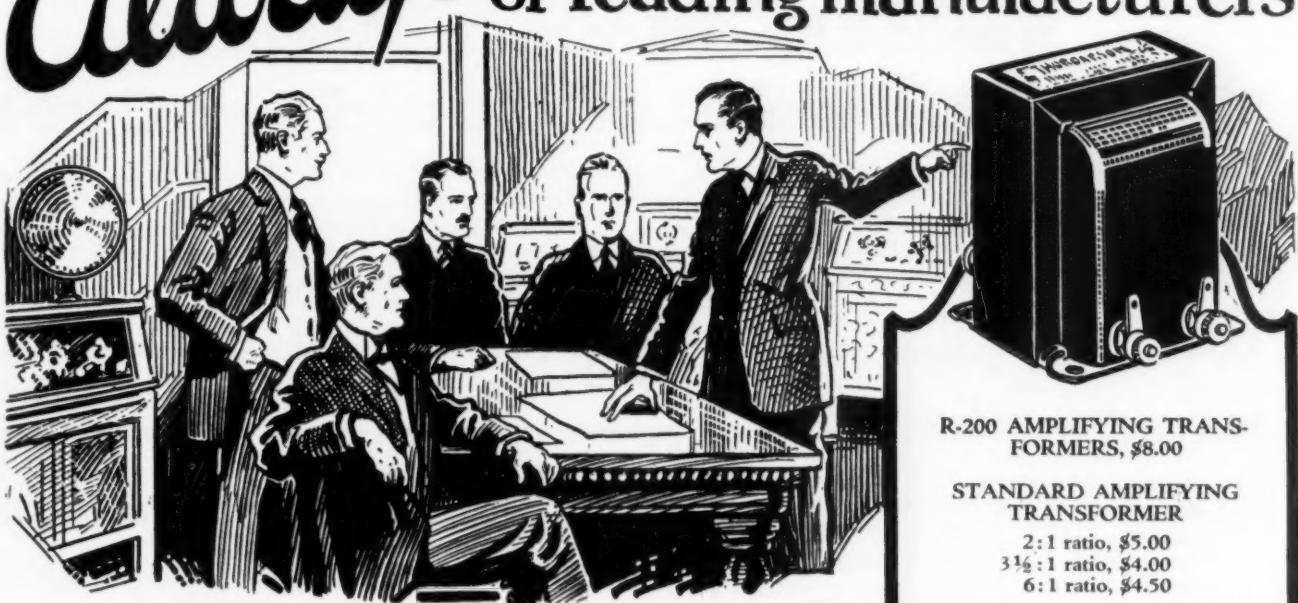
35 EAST WACKER DRIVE

Dept. R

CHICAGO, U.S.A.



Always the first choice
of leading manufacturers



THORDARSON TRANSFORMERS

FEDERAL, Freed-Eisemann, Howard, Kennedy, Murad, Murdock, Pfanstiehl, Prestolite, Radio-dyne, Sparton, Valley, Willard, Zenith. These outstanding trade names are representative of the highest degree of radio workmanship and performance.

No wonder, then, that they should all select Thordarson transformers as best in keeping with the high standards of performance maintained in their receivers and power units.

You, too, can benefit by the careful research of these manufacturers. Whatever your radio problem there is a Thordarson transformer ready for you at your parts dealer.

If you enjoy good musical reproduction, insist on Thordarson transformers.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.

3565

MAIL THIS COUPON

R-200 AMPLIFYING TRANSFORMERS, \$8.00

STANDARD AMPLIFYING TRANSFORMER

2:1 ratio, \$5.00
3½:1 ratio, \$4.00
6:1 ratio, \$4.50

SPEAKER COUPLING TRANSFORMER

R-76, \$6.00

OUTPUT CHOKE
R-196, \$5.00

POWER PUSH PULL TRANSFORMER AND CHOKE

T-2408 Input Transformer, \$8.00
T-2420 Output Choke, \$8.00

AUTOFORMER IMPEDANCE
R-190, \$5.00

POWER COMPACTS
(for power amplifiers)
R-171, \$15.00 R-210, \$20.00

130 M. A. FULL WAVE
RECTIFIER
T-2098 (Transformer) \$20.00
T-2099 (Double Choke) \$14.00

R. C. A. A. C. TUBE
SUPPLY TRANSFORMER
T-2445, \$10.00

McCULLOUGH A. C. TUBE
SUPPLY TRANSFORMER
T-2504, \$7.50

VAN HORNE A. C. TUBE
SUPPLY TRANSFORMER
T-2370, \$5.00

Thordarson Electric Mfg. Co., Dept. G
600 W. Huron Street
Chicago, Ill.
Gentlemen:

Please send me your free booklet on audio amplification and power supply.

Name.....

Street.....

Town..... State.....

1928 "Model DX" Infradyne S Smashes Summer Records.

California Gets Florida — Great! De

Right in the middle of the summer season with static at its worst the new 1928 Infradyne brings in Clearwater, Florida from San Francisco with loud speaker volume. This has not been accomplished in previous years. It clearly demonstrates the marked ability of the Infradyne to bring in stations on

the loud speaker which are inaudible on other receivers. In congested areas the Infradyne is the receiver for bringing in the distance right through the powerful locals. Owners of the new Infradyne receiver have reported to us that they can get 10 kilocycle separation.

Why the New Infradyne Excels

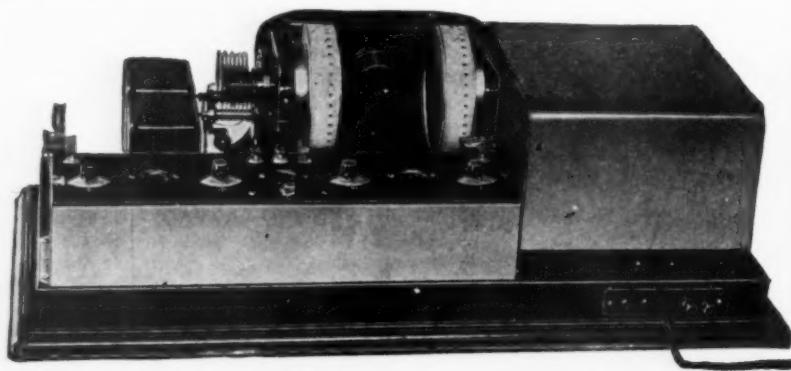
5 or 10 tubes by the throw of a switch on the beautiful bronze control panel mounted in front of the chassis. Throw the switch to the left and you have a single dial control 5 tube receiver for local reception. Throw it to the right and you use 10 tubes. The mighty Infradyne amplifier swings into action and you hear stations on the loudspeaker you never heard before.

Perfect Control of R. F. Amplifier

No spill over—no howling and no squealing. The new "front end," or radio frequency amplifier takes all the grief out of reception. The coupling is controlled by the condenser as it turns. Equally efficient at all wavelengths. When used as a 10 tube set both dials read within two degrees of each other. This new r. f. amplifier is the smoothest operating and most efficient unit in the 1928 radio field.

Single Spot Tuning

The Infradyne is noted for its single spot tuning. No overlapping of stations—no carryover. You get the station ON THE DOT—and no place else.



Interior View of Completely Assembled Infradyne

NOTE the beauty of construction—the extreme simplicity of this 10 tube giant of the air. The radio frequency amplifier completely housed in a pure copper can, beautifully burnished. The Infradyne amplifier in its copper case. The bronze control panel on which is mounted a Jewell voltmeter, 5-10 tube switch, head phone plug, on-off switch, Infradyne amplifier tube voltage rheostat, sensitivity and volume control. The wiring is in place but is practically

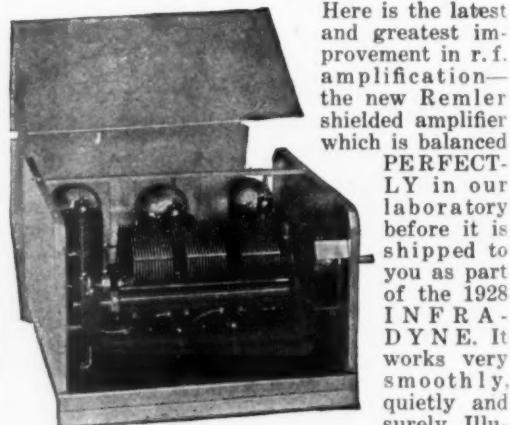
invisible because most of the wiring is below the steel chassis upon which the units are mounted. A masterpiece of construction and engineering. Built to last for years. And remember—we do 90% of the wiring for you. Just attach a few leads and your receiver is ready for operation. Parts sold separately if desired. Price of kit of all parts is \$7 less than the completely assembled job. Battery cable goes with set. Pure copper cabinet included in the price. This cabinet is a beauty.

\$179.50

Completely Assembled, Balanced, Tested and
Guaranteed. You Finish it in Half an Hour.

ALL orders received during
8 hours. Send your check
ceiver without reservation. It
distance—with more volume
receiver. Perfect tone quality.
operation. Works on batteries
You don't know radio till you

Wonderful R. F. Amplifier



Here is the latest and greatest improvement in r. f. amplification—the new Remler shielded amplifier which is balanced PERFECTLY in our laboratory before it is shipped to you as part of the 1928 INFRADYNE. It works very smoothly, quietly and surely. Illuminated drum dial controls. As the dial turns the coupling of the coils varies—making it equally efficient over the whole broadcast wave band. Imagine the results you can expect from a perfect radio frequency receiver—hooked on to the Infradyne amplifier. The whole receiver in perfect balance—under perfect control at all times. Radio as you have always wanted it. It's here at last.

The Shortage Threatened — Buy Now and Play Safe. Demand Already Exceeds Supply!

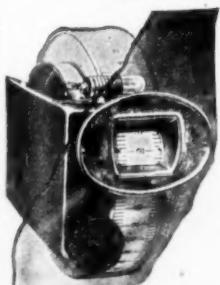
Those who have already purchased the new 1928 Infradyne are loud in praise of this great improvement in radio. The word is spreading like wildfire and already a serious shortage is threatened. After September it will not be possible to guarantee prompt deliveries. For this reason we urge you to

order your Infradyne now. We promise to make immediate delivery to you. Telegraph your orders if you want quick action. When you buy the Infradyne from us you are insured in advance of SUCCESS. We balance and test each assembly and guarantee it FULLY.

Completely Assembled and 90% Wired..... \$179.50
Note — This is only \$7.00 more than the cost of the parts.

September will be filled within now. We guarantee this new receiver brings in more stations, more and clarity — than any other Hair splitting selectivity. Quiet or eliminators equally well. hear the INFRADYNE. ☺

Vital Improvements



Apparatus Used
Make The Set 50%
Better Than Before

NEW ANTENNA COMPENSATOR

A variocoupler with three taps for long, medium or short antenna keeps the radio frequency amplifier at peak operation and in perfect balance with the "front end."



3,200,000 CYCLE AMPLIFIER

The Sargent-Rayment Infradyne Amplifier is the heart of the new 1928 Infradyne. Stations absolutely inaudible on this receiver when used on 5 tubes come in with great volume when you throw the switch for 10 tube operation with the Infradyne in action.

Here Is What You Get

A COMPLETELY assembled receiver, with a pure copper cabinet as illustrated here. The cabinet is finished in baked crystalline — of a neutral shade. A hand finished hardwood base goes with



the cabinet. Nothing else to buy except your usual accessories. The price of \$179.50 brings the whole receiver to you, securely packed for safe shipment to any part of the world. When you get the receiver from us you connect a few short

We recommend the 112 tube in the 2nd audio stage. This tube does not require an output transformer and no output transformer is supplied with our assembly. We can furnish output transformers for \$8.00 additional.

wires and you are ready for the surprise of a lifetime. The receiver measures only 26 inches long and 11 inches deep — the standard size to fit consoles or mount on radio tables. Jewell voltmeter is mounted

Order Directly From This Advertisement

Send Check, Money Order or Draft for \$179.50 and shipment will be made same day your order reaches us.

WE ALSO SELL TO DEALERS AND COMMUNITY SET BUILDERS.

RADIO CONSTRUCTORS CORPORATION 357 Twelfth Street, Oakland, California.

Here is my check for \$179.50 for which you will at once send me one 1928 Model DX INFRADYNE exactly as described in "RADIO" for September. It is fully understood that my receiver is to be shipped at once.

Name.....

Address.....

City and State.....

(Note—We ship by express if not otherwise stated.)

If you are not ready to buy, send for free booklet—"RADIO PAR EXCELLENCE" giving further details.

1928 INFRADYNE PARTS

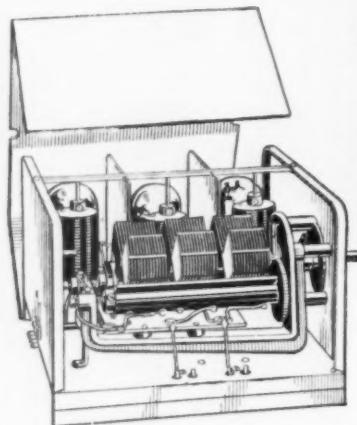
Prompt Mail Order Service to Any Part of U. S. • Deliveries in 8 Hours

Immediate deliveries are now being made on all of the parts and assemblies for the 1928 Model DX Infradyne. The demand for these parts has been greater than the supply during the past month. In order to be sure of getting 8 hour mail order service you must purchase these

parts during September. In October the demand will again exceed the supply and orders will be subject to delay. Order your new Infradyne parts directly from this advertisement. We ship same day your order reaches us. All merchandise sold by us is guaranteed fully.

The 1928 Infradyne Proves All Claims

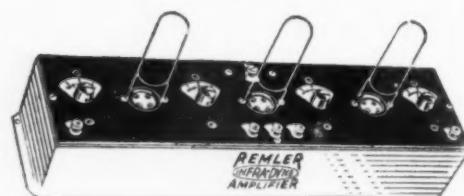
— *Testimonials from New Owners Proves Its Superiority. Build Yours Now and Enjoy New Radio Thrills.*



Specifications —

Three coils. Three tube sockets. Pure copper case houses entire unit. Remler 3-in-line variable condenser with compensating condensers attached. Completely wired with heavily insulated wire. Bakelite connection blocks with soldering terminals. Removable copper lid makes inspection easy. Holes drilled through top for adjusting compensators. Tunes from 200 to 550 meters. Makes a perfect single dial control unit. This r. f. amplifier can be used for building single dial control receivers or for use in any circuit where maximum efficiency is desired.

\$55.00



The 3,200,000 Cycle Amplifier

The Remler Infradyne Amplifier is the secret of success behind the smashing records being made for the new Infradyne. This Sargent-Rayment principle of amplification at the high frequencies is the only practical means for reducing background noises, long wave interference and harmonics. Built in a copper case with bakelite top. Three tube sockets and 4 adjusting verniers are mounted on top of the amplifier.

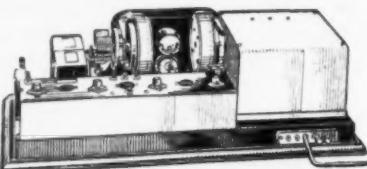
\$27.50

Order By Mail Directly From This Ad

RADIO CONSTRUCTORS CORPORATION
357 Twelfth Street, Oakland, California

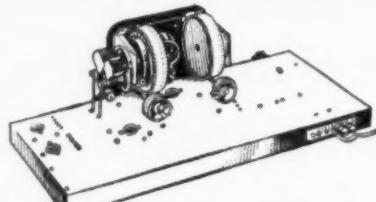
My remittance of \$..... is enclosed. Send me, at once, the following parts for the new 1928 INFRADYNE as advertised in "RADIO."

Name..... Address.....



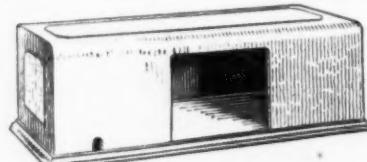
Here's Real Engineering

The completed 1928 Model DX Infradyne with the essential units mounted on the steel chassis. 90% wired. You connect a few leads and the set is ready for operation. The completely assembled Infradyne is supplied by us, with the wiring 90% completed, for only \$179.50. This is seven dollars more than the cost of parts purchased separately. A pure copper cabinet goes with this price. Jewell voltmeter and 2 Silver Marshall 220 audios included in price. \$179.50 covers the entire receiver.



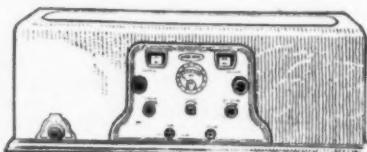
The Steel Chassis and Panel

Here is where you get rigidity, fool-proof construction and beauty in building the Infradyne. The chassis of steel is die punched with all holes drilled for wiring leads. The control panel is attached to the chassis. Wiring goes below the chassis. A factory job throughout. The new idea in radio. Complete foundation unit, with all small parts \$52.00



The Pure Copper Case

Built for appearance and strength. A pretty crystalline finished copper cabinet. Hand finished hardwood base. Easily removable from set. Embossed on top and sides. Size, 26x11 in. \$15.00



The Completed Receiver

Here you see the entire 1928 Infradyne as it looks in its copper cabinet, with the control panel in place. It has the appearance of a \$500 receiver. Antenna compensator can be seen at the lower left of the picture. Loud speaker, antenna and ground posts on rear and headphone plug in front. Switch for 5 or 10 tube operation on bronze control panel. Remler illuminated drum dial controls. You get this complete assembly for \$179.50. Rebuild your old Infradyne into a 1928 model for \$122.00. Let us tell you how to do it.

ABOX

"A" BATTERY ELIMINATOR



Slightly Higher
West of
The Rockies

Licensed by The
Andrews-Ham-
mond Corpora-
tion, under Pat-
ent No. 1,637-
795 and appli-
cations



Input—110 volts, 60 cycles A. C. Output—6 volts
direct current, 2 amperes. Shipping weight, 25 lbs.
Unlimited shelf life.

You, Too, Can Have Electric Radio Operation

THE ABOX completely eliminates the storage battery and its troublesome accessories, and will run your radio set more efficiently.

Night after night, year after year, the ABOX is always at your command, delivering perfect "A" power to *any* set using up to eight tubes.

ABOX "A" power is free from all crackling noises and background common to battery operation.

A rectifier and the well known ABOX Filter are incorporated in the ABOX.

It takes the current straight from the light socket and delivers it to your set as pure, unvarying, 6 volt direct current. ABOX *has no battery and operates only while your set is in use*.

See the ABOX, hear it on *any* set, learn how easily it can be attached to your own receiver and what it will mean to you in convenience, economy and unequaled radio satisfaction. Your radio store has it.

The ABOX Filter is an entirely different unit from the Eliminator, being the filter circuit alone in a small, compact unit. If you have a suitable charger it can be easily converted into an "A" Eliminator by substituting the ABOX Filter for the storage battery. Shipping weight, 11 lbs. Price \$19.50. Slightly higher west of the Rockies.

Send for interesting booklet,
"ABOX and The Light Socket"

The Abox Company

215 North Michigan Avenue

Chicago, Illinois

Tell them that you saw it in RADIO

A Completely NEW Standard of Radio Engineering

THE history of radio engineering is that of every other industry. From simplicity to complexity—and in its final state of perfection, back to *simplicity* again. And the Royal Series AMRAD Neutrodyne brings radio engineering to its present state of *unbelievable simplicity*, united with a ruggedness hitherto unapproached.

True one-dial control which gives every phase and range with ease and assurance. Genuine full copper-shielding, eliminating interference. The exclusive AMRAD tone-filter for purity of reproduction, illuminated dials, which are calibrated with wave lengths, which means you simply turn to

400 when you want a station broadcasting on 400 meters. And as the result of fine construction, you have—*ultra selectivity* and simple operation, with a *wonderfully deep, smooth, mellow tone*, richly beautiful and natural. Let us send you descriptive booklet, with name of nearest dealer.



THE BERWICK (Above)
Six - tube Console, in dark selected walnut with built-in cone speaker. Single-dial control. Pure and sweet tone quality. Very selective. Loop or antenna operated.

\$195

Equipped for lamp-socket operation, requiring no batteries of any kind.

\$295

THE WINDSOR
(To the right)

Seven-tube Compact, pure one dial control, extremely selective. Operated on loop or antenna. All parts completely copper-shielded.

\$195



THE HASTINGS
Single-dial control, seven-tube Console, operated by loop or antenna; one of the richest cabinets ever used for a radio set. Built-in cone speaker, mounted on special baffle board. Panelling of beautiful etched croch walnut on the outside, and selected figured walnut on the inside.

\$295

Equipped for lamp-socket operation, requiring no batteries of any kind.

\$395

Prices slightly higher west of the Rockies

The
Royal Series **AMRAD**
NEUTRODYNE

Tell them that you saw it in RADIO

30^D A^Y S^TRIAL

Battery or All-Electric OPERATION

HERE is the great value offer of the day. Test and try this powerful seven-tube RANDOLPH RADIO for thirty days. After it brings in stations from coast to coast with amazing clearness—with easy one-dial tuning—after it easily equals any other radio regardless of cost—after you are more than satisfied then you can buy it direct at factory prices. Every RANDOLPH must make good before it is sold.

The RANDOLPH SEVEN-TUBE CONSOLE illustrated here can be had for use with batteries or connected direct to the electric light socket—absolutely batteryless—no batteries, chargers or acids—just plug in and tune in. 100% efficient either way. Its construction and performance have been tested and approved by leading radio engineers and authorities—by leading radio publications and laboratories.

7 Tubes—Single Control Illuminated Drum

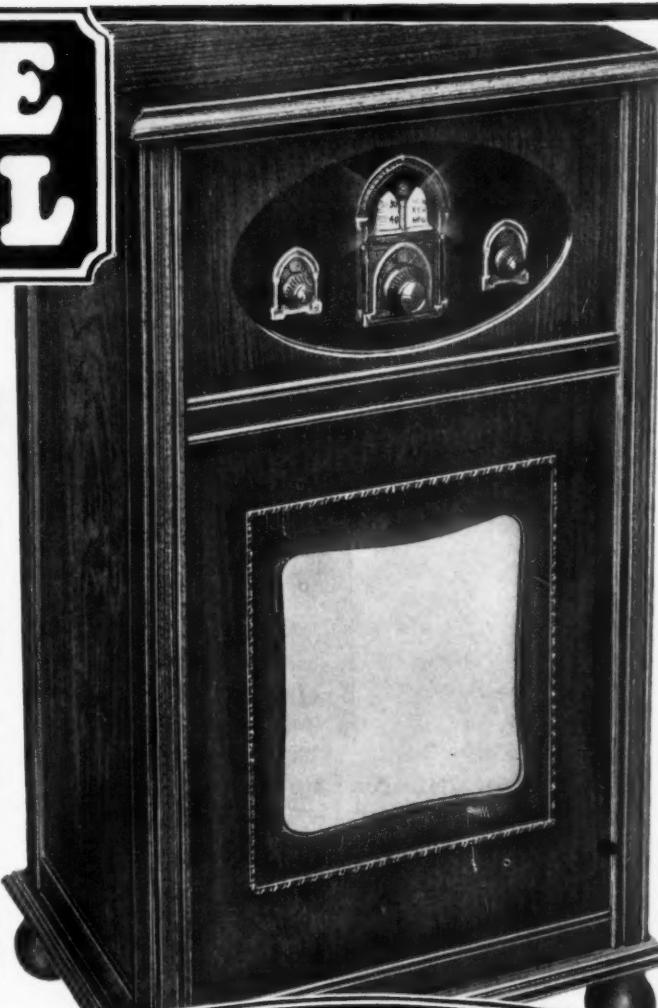
One drum dial operated by one simple vernier control tunes in all stations with easy selectivity to tremendous volume. No overlapping of stations. Illuminated drum permits operation in the dark. Volume control for finer volume modulation. This is a seven-tube tuned radio frequency receiver with power transformers and power amplification. Space wound solenoid coils. Full and completely shielded. A real receiver of the highest quality. Tremendous distance, wonderful tone quality, simple to operate.

Beautiful Walnut Console Built-in Cone Speaker

The Randolph Seven-tube Ampliphonic Console illustrated above is housed in a genuine burl-walnut cabinet with two-tone hand rubbed finish giving it unsurpassed beauty. The same expert cabinet work has gone into the making of these consoles as in the finest furniture. Has built-in cone loud speaker that compares with any on the market. Accurately reproduces complete range of musical notes from the highest to the lowest pitch.

What Users Say

I have logged more than 50 stations from coast to coast.—Lloyd Davenport, Littlefield, Texas. I have logged 52 stations from Cuba to Seattle, the set is a world beater.—J. Tampkinson, Detroit, Mich. Your set is a revelation, has all others tied to the post for distance and selectivity.—Waldo Powers, Vergennes, Vermont. On strength of its performance sold two more sets this week.—T. Scanlon, Orlando, Florida.



The **Randolph** \$ **99**
7-Tube Console
Single Control
RETAIL PRICE
Completely Assembled

**Sensationally Big
Discounts to Agents**

Work either full or part time and make big money. Tremendous advertising campaign helps you sell. Regardless of whether you have ever sold before, be sure to get our proposition. The Randolph sells on first demonstration. Men and women both can make money this easy way. Get your demonstration set for thirty day's **FREE TRIAL**.

Use This Coupon NOW!

Randolph Radio Corporation
711 West Lake Street, Dept. 125
Chicago, Illinois.

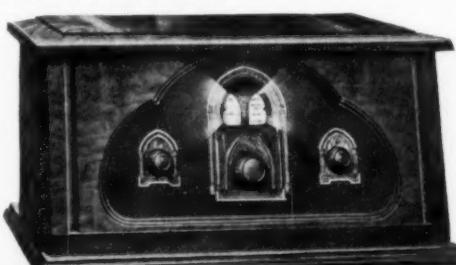
Send me full particulars about the RANDOLPH Six and Seven-Tube All-Electric and Battery Table and Console Sets with details of your **30 Day FREE Trial Offer**.

Name.....

Address.....

City..... State.....

Mark here if interested in Agent's proposition.



**MAIL
COUPON
NOW!**

**6-Tube
\$ 55
Retail Price
Single Control**

The Randolph Radio Corporation are pioneers in the manufacture of radios. All of its vast and unlimited resources have been used in making and perfecting of the Randolph Receivers. Because of our long and successful experience in the radio business, we are perfectly confident in sending out a Randolph Radio on trial. We know what it will do. Mail us the coupon now for the greatest radio offer ever made.

The Senior Six
Now you can have a new, modern, single-control, six-tube radio. Do not compare this set with old style 2-dial 6-tube sets selling for about the same price. The Randolph 1928 Senior Six has also been tested and approved by the leading radio engineers. Comes in a beautiful solid walnut cabinet of hand-rubbed finish. Single control. Illuminated Drum. Space for logging. Absolutely dependable and very selective. **Sent for 30 Days' Free Trial. You test it before you buy.**

RANDOLPH RADIO CORPORATION
711 West Lake Street Dept. 125 Chicago, Illinois

Tell them that you saw it in RADIO



The Advice of Men Who KNOW Radio: "Get a BROWNING-DRAKE!"



Model 6-A

WHEN radio amateurs—men who KNOW radio, are asked by their friends and neighbors to recommend a dependable radio set, they almost invariably reply "Get a BROWNING-DRAKE!" Why? Because these amateurs have tested every Browning-Drake development themselves and found it to be scientifically sound. They know therefore, that their reputations as engineers and amateur scientists are safe when they recommended Browning-Drake. This unusual recommendation has put Browning-Drakes into over two hundred thousand homes.

Recently the laboratories of the Browning-Drake Corporation presented an entirely new conception of the world-famous Browning-Drake Receiver. Tone, volume, selectivity and distance ability have never before been combined in a single receiver in the same fine way they are brought together in

the new Browning-Drakes. These receivers are unconditionally guaranteed and will, we believe, more fully uphold the reputation of the man who KNOWS radio when he advises, "Get a BROWNING-DRAKE!" Ask your dealer to show you the new Browning-Drakes TODAY.

SPECIFICATIONS:

Browning-Drake, Model 6-A: (illustrated above), uses conventional Browning-Drake circuit with slight modifications. Four audio tubes give natural tone and great volume when desired. Small auxiliary condenser is provided to bring signals of distant stations to maximum intensity. Beautiful two tone Duco walnut cabinet harmonizes with all home furnishings. Length, 27 inches; depth, 15 inches; height, 11 inches. List without tubes and batteries, \$105.

BROWNING-DRAKE CORPORATION
CAMBRIDGE MASS.

DEALERS: Browning-Drake now offers a complete line of receivers and kit parts. Almost three times as many Browning-Drake parts are sold as those of the nearest competitor. Write or wire for further information TODAY.



Model 5-R

Five tubes. Uses three stages of resistance-coupled amplification. Provision for power tube in last audio stage. Cabinet is two tone Duco mahogany finish. List without tubes and batteries \$95.00



Model 7-A

Seven tubes, single dial, illuminated drum control. Completely shielded. Cabinet can be had in either two tone Duco mahogany or walnut. Length 30 in.; depth 15 in.; height 11 in. List without tubes and batteries \$145.00

BROWNING DRAKE

CABINETS
PARTS

RECEIVERS
KITS

Tell them that you saw it in RADIO

SEP 23 '27

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RADIO

WITH WHICH IS INCORPORATED "RADIO JOURNAL"

VOLUME IX

OCTOBER, 1927

No. 10

Radiotorial Comment

The question as to what has been accomplished by the Federal Radio Commission is frequently raised. With less than half of its legal life as the

What the Radio Commission Has Done supreme arbiter of radio behind it, an exceedingly favorable reply can be given. Briefly, it has brought

about a remarkable reduction in summer interference and it has more clearly defined what best serves "the public interest, convenience and necessity."

Two months' experience with the new allocations and power assignments has shown them to be a great improvement over those used before the commission took the reins. Local reception has been better than it was last summer in all parts of the country. With a selective receiver it is now possible to separate local stations so as to receive a good rendition of almost any desired program.

As was to be expected, complaints have come from stations which were not given preferential treatment. Each application for change was given a hearing and where circumstances justified, it was granted. Nearly a hundred changes have already been made in the allocations effective June 15th. Yet the majority of applications were denied. Nor has any appeal yet been taken to the courts, though there is reason to believe that the commission would welcome court decision as to the constitutionality of the Radio Act and as to its authority.

The commission has taken the stand that it has no authority over the local site of a station, this matter resting with the ordinary police power of the community affected. A limited number of construction permits have been issued for new stations to be erected in locations not already adequately served by radio, but otherwise no additional stations have been licensed to broadcast.

There has been much discussion relative to the use of radio for direct advertising but no ban has been placed upon it. The Federal Trade Commission has issued a formal complaint against one concern which is alleged to have made untruthful statements about its product in the course of its broadcast advertising.

From the foregoing summary it is evident that there has been an orderly progression in clearing up the previous chaos. But there remains one important point to be determined. It has been necessary to assign many stations to single channels upon which other stations are operating. While there has been but little heterodyning between these stations during the summer, there is a well-founded fear that as winter approaches there will be many persistent whistles which no tuning can obviate.

It is freely predicted that this condition will require

Congressional action as the remedy. It could be eliminated within the present broadcast frequency limitations by closing about half the stations now on the air. But these should not be closed without compensation for at least their cost of equipment. Otherwise a confiscation of property rights is involved.

This will be a real test as to the authority of the commission. Any unbiased listener realizes that the winter air will be over-saturated with broadcasting. Can the commission precipitate the least desirable stations and who is to pass upon station fitness? Action to such an end would inevitably result in the cry of monopoly. But here the question remains as to whether regulated monopoly is not preferable to unregulated chaos. Time will give the answer.

That radio is relatively more essential to aerial than to water navigation has been emphatically demonstrated in recent transoceanic flights. The success of

Radio for Aviation the army beacons in guiding planes from San Francisco to Honolulu, the communication established by Byrd in his trans-Atlantic flight, and the radio-established certainty of the location where the ill-fated *Dallas Spirit* and *Old Glory* took to the water, are positive proofs of its value.

Negative proof is furnished by the uncertainty of the fate of other unfortunate flyers. If their planes had been equipped with transmitters they might have been rescued. A plane without radio will some day be as proverbially helpless as a ship without a rudder.

Radio is capable of aiding aviation to a greater degree than any other agency not actually used in propelling the plane. And some day radio power will replace the gas engine for airplane propulsion. But today it is indispensable for maintaining communication to and from a plane that can be reached by no other means.

The early objection of the great weight added by a transmitter has been overcome by the development of short wave equipment where a 50-watt set need not weigh as many pounds. Short waves have amply demonstrated their ability to span land and sea so that a plane can always be in close touch with its base.

A ship on the sea, carrying fifty or more people, is obliged by law to carry radio equipment and operator. Is there any reason why a ship in the air should not likewise be compelled to protect the lives of its occupants, even though they are fewer in number? Decidedly, no. Action to this end is now pending the assembly of Congress. There should be no delay in enacting it into law.

Radio in the Honolulu Flight

Including a Detailed Account of the Short Wave Transmitting Equipment
Used on the "Dallas Spirit"

By Arthur Hobart

THE tragic disappearance of three planes in the recent Honolulu flight, and its aftermath, the search for the missing fliers by the gallant Erwin and Eichwaldt, has brought to public attention, as never before, the service that radio can render to the aviator on long flights over water, and the efficiency of the short wave as a medium for airplane signals. In the Dole contest, nine planes were entered, of which two reached the goal, two disappeared, and the rest either crashed at the takeoff or were disqualified. Subsequently, Erwin and Eichwaldt, in the plane *Dallas Spirit*, which had originally taken off in the contest but returned because of a torn fuselage, started out to search for the lost fliers, and gave to the public a log covering a six hour period that was as replete with thrills as any movie thriller, ending with a climax which is seared across the memory of those who listened.

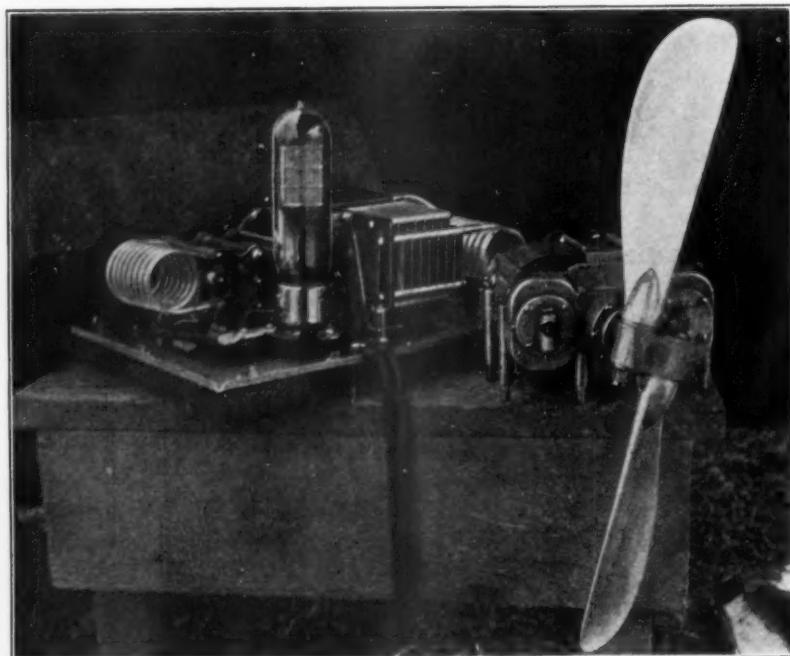
In reviewing briefly the part radio played in the flight, a list of the radio equipment carried on the various planes is of interest. The winner of the flight, the *Woolaroc*, carried a radio beacon receiver, and a 600 meter tube transmitter. The beacon signals from San Francisco and Hawaii were picked up successfully through most of the trip, and materially aided the fliers in reaching their destination. The beacon stations were the same as used by Maitland and Hegenberger in their June flight, as described in August RADIO. The 600 meter transmitter was used to communicate with ships while passing

over them, but not for communication with land. Their signals were lost to those on shore after the plane was 150 miles out.

The *Aloha*, second prize winner, carried no radio equipment, and depended entirely on the skill of the navigator to reach the goal. The missing *Golden Eagle* was originally equipped the same as the *Woolaroc*, but the transmitter was removed at the last minute to lighten the load, and only the beacon receiver was retained. Since this plane has not been heard from, its fate is a

mystery, along with the *Miss Doran* plane, which carried no radio. Both the *El Encanto* and the *Oklahoma*, which were disabled on the takeoff, were equipped the same as the *Woolaroc*, while the *Dallas Spirit* on its original takeoff had no radio equipment. The *Pabco* flier, piloted by Major Irving, was equipped with a 33 meter tube transmitter, and a beam receiver, but the plane "cracked up" on the takeoff and was out of the race. It was with this plane's radio equipment that radio history was subsequently made.

After the failure of the *Miss Doran* and the *Golden Eagle* to reach their goal, without news of them, Erwin and Eichwaldt in the *Dallas Spirit*, which had been repaired after its false start in the contest, decided to take off on a flight to Honolulu over a zig-zag course, searching for the lost fliers. As this involved a greater distance than laid out for the contest flights, a maximum load of gasoline was taken aboard, and a course laid out which would take them over as much of the region where the lost fliers might be found, as was possible. The 33 meter transmitter was removed from Major Irving's damaged plane, and installed in the *Dallas Spirit*. The transmitting license with call KGGA, was transferred with the equipment. Both Erwin and Eichwaldt were expert operators, and thoroughly familiar with radio telegraphy.



Radio Transmitter and Generator, Ready for Installation on "Dallas Spirit."



Position of Generator on Wing of Plane.

The pictures show the radio equipment after it was removed from the *Pabco* plane, preparatory to installation in the cockpit of the *Dallas Spirit*, as well as the location of the wind driven generator which furnished the power supply for the filament and plate circuit of the transmitter. The transmitter was designed and built by Heintz & Kaufmann of San Francisco. The circuit is shown in Fig. 1. It is the well known tuned-grid-plate circuit popularized by Ralph Heintz and its uses in various types of transmitters have been described many times in **RADIO**.

The transmitter was of the fixed tuning type, adjusted to 33.1 meters, and the tuning control, which is the grid tuning condenser, adjusted permanently. The antenna system consisted of the frame of the plane as counterpoise, and a 28 ft. wire weighted down with a lead fish on the end, for antenna. Spare antennas were carried on the plane in case the regular antenna was carried away.

The power supply was a special Aladdin Duplex generator, built by the Harris Electric Co. of San Francisco specially for the job. The generator had two armatures, one for 10 volts, 240 cycles, to light the filament of the UV-203-A tube and furnish power for the lights on the instrument board, and the other for 65 volts, 240 cycles, to supply the plate transformer, which had a 65 volt primary and 900 volt secondary. The generator was driven by an 18 in. impellor, and was mounted on the forward edge of the fuselage in the slipstream, so that at normal speed of the plane, around 100 miles an hour, the frequency of the generator would be 240 cycles. The generator was self regulating as to voltage, without commutators or governors of any kind, an innovation in machines of this type.

Keying was accomplished in the primary of the power transformer, two keys being used; one in the forward

cockpit for the pilot, and the other in the rear compartment where the navigator had his charts. Contrary to newspaper reports, the plane carried no storage batteries, the only battery aboard being a dry battery for lighting the wing tip lights while flying at night. The entire transmitter and generator weighed but 39 pounds.

The plane left Oakland airport at 2 p. m. and its signals were immediately picked up by those who were listening on 33.1 meters. At the home of Ralph Heintz, a continuous watch was kept from the minute the plane took off, with Fred Roebuck, former operator of KFUH, at the receiver, and reporters from the newspapers taking down the log as fast as it was received.

The keys were kept closed on the plane when no messages were to be transmitted, so that the listeners heard a continuous 240 cycle note which did not vary in intensity or wavelength during the entire flight, except when the tail spins ended the flight in tragedy. As evening came, and the plane reached a distance of 500 miles from shore, the signals continued to remain R-9 at all times. At the time of this writing, reports of their reception have been received from Italy, the South Atlantic ocean, and all districts of the U. S. In every case the signals were reported loud and steady, easily readable at all times. In New York, the entire transmission was picked up at the New York *Times* station 2UO, so that the news was released to the press as fast as it was transmitted from the plane.

When the tail spins came, the whine of the generator rose to above 500 cycles, indicating that the plane was going at a rate of over 200 miles an hour. Throughout both tail spins the generator functioned perfectly, the voltage regulators preventing the tube from having its filament burned out, or the plate circuit overloaded, and the transmitted wave remained as steady as a

rock. The fact that Eichwaldt remained at the key, sending out the dots and dashes of his last message while the plane was hurtling downward at a sickening speed is an everlasting tribute to his courage and presence of mind, even in the face of certain death. Those who listened on shore will never forget the howling and screeching of the notes when the plane went into the tail spins and KGGA was no more, after a life of only $6\frac{1}{2}$ hours.

RADIO, FROM AN AMPLIFICATION STANDPOINT

By SIMPLETON FITTS

By SIMONETTE PITTS

RADIO broadcasting is very largely a matter of amplification, which means exaggeration or magnification. A sweet voiced little singer, barely whispering her sentiment into the microphone, would be greatly surprised if she could know that her voice was filling a large hall 100 or 1000 miles away. In this respect, the radio very much resembles the moving pictures, which use a tiny piece of celluloid an inch or two square to make the huge picture the patron sees on the screen.

For this reason the technique of a radio performer must be almost perfect. If not, the imperfections are exaggerated to many times their actual value. If a singer hits B flat when the proper note is B, it will sound like he has missed his mark by half a dozen notes instead of a half note. If a piano player falls off of his stool it is liable to create the impression in some one's home that he has a wooden leg and has tumbled down a flight of stairs.

This is the reason a radio announcer must be very careful of what he says or does when near a live, absorbing microphone. If he mispronounces the name of a composer it will sound bad enough when emerging from the loud speakers to give sound basis to a conjecture that he is trying to speak pig Latin. If he leaves out a word it will sound like the station has gone off the air for two or three minutes.

If an announcer were to say "darn" at a microphone, you can well imagine what a terrible curse it would develop into by the time the thousands of radio sets had exaggerated it. Once an announcer told his wife over the air that he would be home in two hours. (He was using a secret code.) She had a very powerful set with all nine tubes burning bright enough to read by and it sounded like he said two weeks. So she packed up and left him.

We heard last August of an announcer who burnt out 2178 tubes in the receiving sets of his listeners simply by announcing "Red Hot Henry Brown" with a great deal of feeling. One shudders to think of the conflagrations which would be started if Dante's

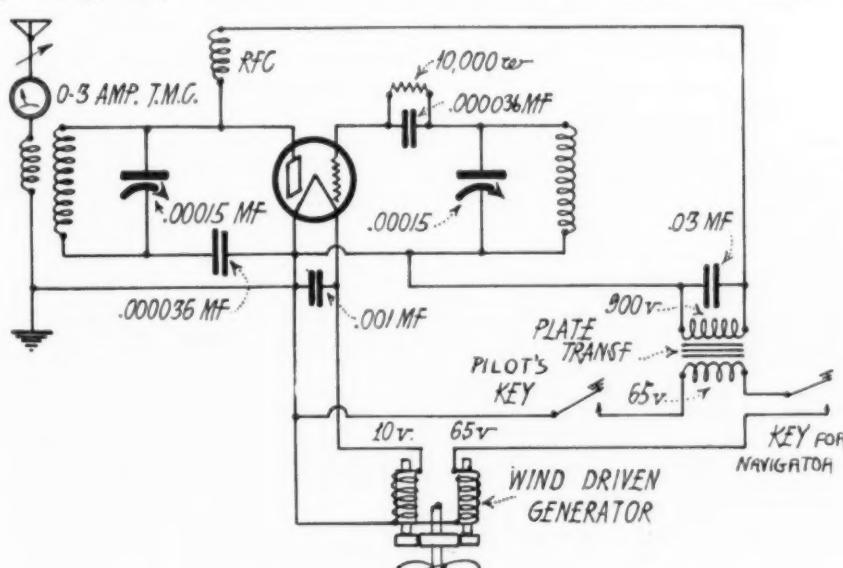


Fig. 1. Wiring Diagram of Transmitter Used on "Dallas Spirit" Plane.

The Tyrman Ten

Complete Directions for Assembling A New Ten Tube Receiver Having Unusual Selectivity, Sensitivity and Tone Fidelity

By E. Tyrman

SIMPLICITY of wiring, beauty of appearance, and remarkable selectivity and tone quality and volume are the outstanding features of the Tyrman Ten receiver. It has but two tuning controls, which may be operated with one hand and which have but one point on each dial for each station setting.

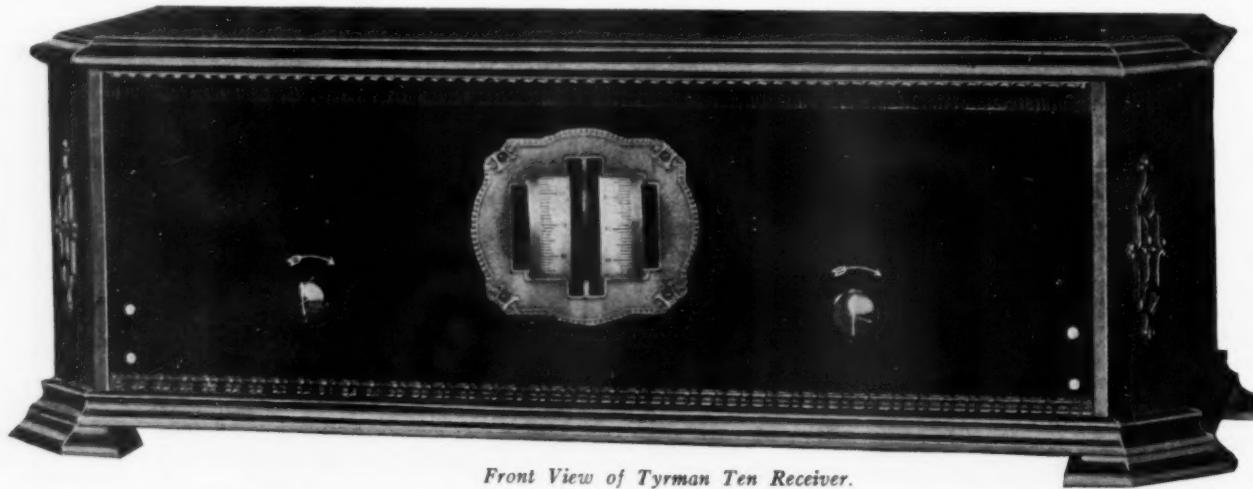
All battery wires are eliminated by the use of a capacity type connector strip. Once this strip is connected at the various terminals, the remaining wires can be run in a few minutes, making the wiring of the set a matter of an hour or so. Handsome drum dial tun-

ing features of the set, which consists of a front panel 7x26x3/16 in. on which are mounted only the twin drum dials with associated tuning condensers, the volume control potentiometer, and the combination rheostat-filament switch. On the subpanel, which is the same size as the front panel, the tube sockets, r.f. and audio transformers and the capacity connector strip are mounted in a uniform manner so that the connecting wires are unusually short and troubles introduced by long, parallel connecting leads are reduced to a minimum.

the set. Once the theory of connections in the strip is understood, the assembly and wiring of the strip is a matter of a few minutes.

Fig. 1 shows the schematic wiring diagram. In Fig. 2, the same connections are shown in pictorial form, the latter diagram having been so arranged that it serves as a sub-panel layout at the same time.

Referring to the schematic diagram, the circuit consists of a stage of non-oscillating r.f. amplification, a mixer tube to which the output of an oscillator tube is capacitively coupled, three



Front View of Tyrman Ten Receiver.

ing control, with the finished appearance of a factory built set, uniform construction of the transformers, and the use of shielded tube sockets aid in the attainment of a compact and neat assembly. A new type of air core r.f. transformer with fixed secondary tuning gives a degree of selectivity and sensitivity even beyond that required for consistent long distance reception in congested city districts like Chicago.

The pictures show clearly the con-

The Kurz-Kasch connector consists of a number of brass strips moulded into bakelite in such a manner that there is an electrical capacity, amounting to as high as .002 mfd. in some cases, between the various strips which are used for the negative and positive A, B and C battery bus bar wires. The battery leads in the form of projecting brass strips with holes at the ends, are brought out every inch or so, to connect the various sockets and transformers in

stages of r.f. amplification at 380 kilocycles, a detector tube, and two stages of transformer coupled audio amplification, the second audio stage being of the push-pull type, with two type CX-371 power tubes.

The set has been designed to be selective on a long outdoor antenna, so that with a small antenna it will have a degree of selectivity far beyond that required for ordinary reception. The antenna is coupled to the r.f. tube input

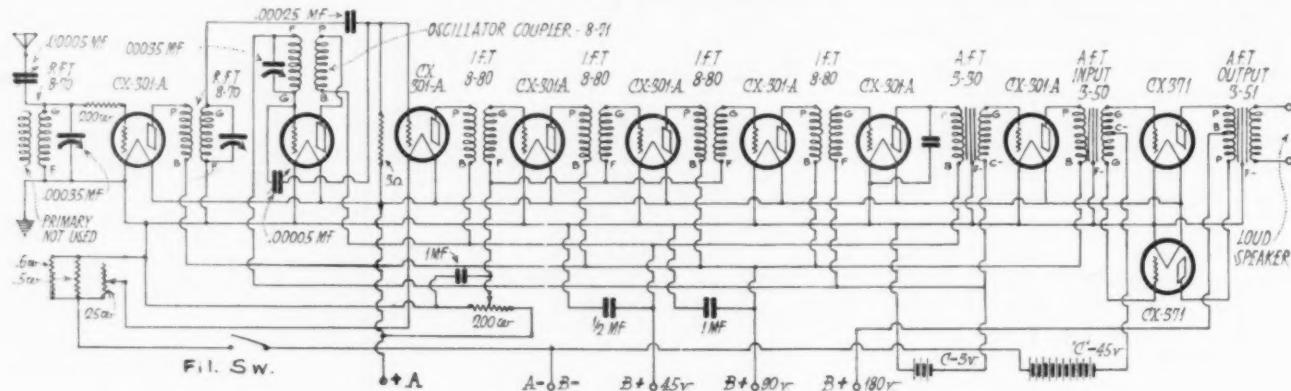
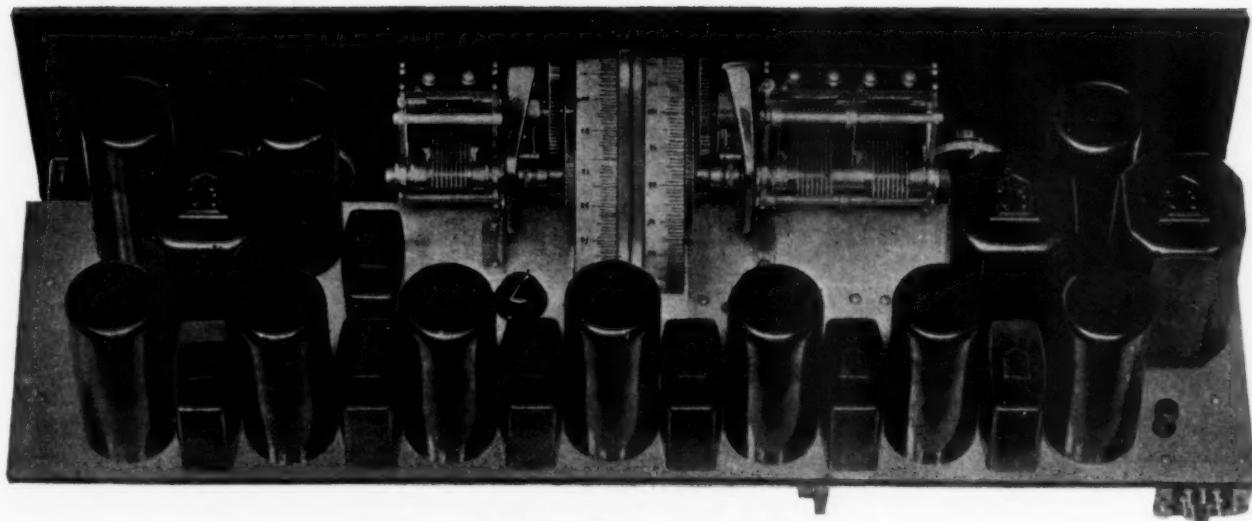


Fig. 1. Schematic Wiring Diagram.



Rear View, Showing Tube Shields.

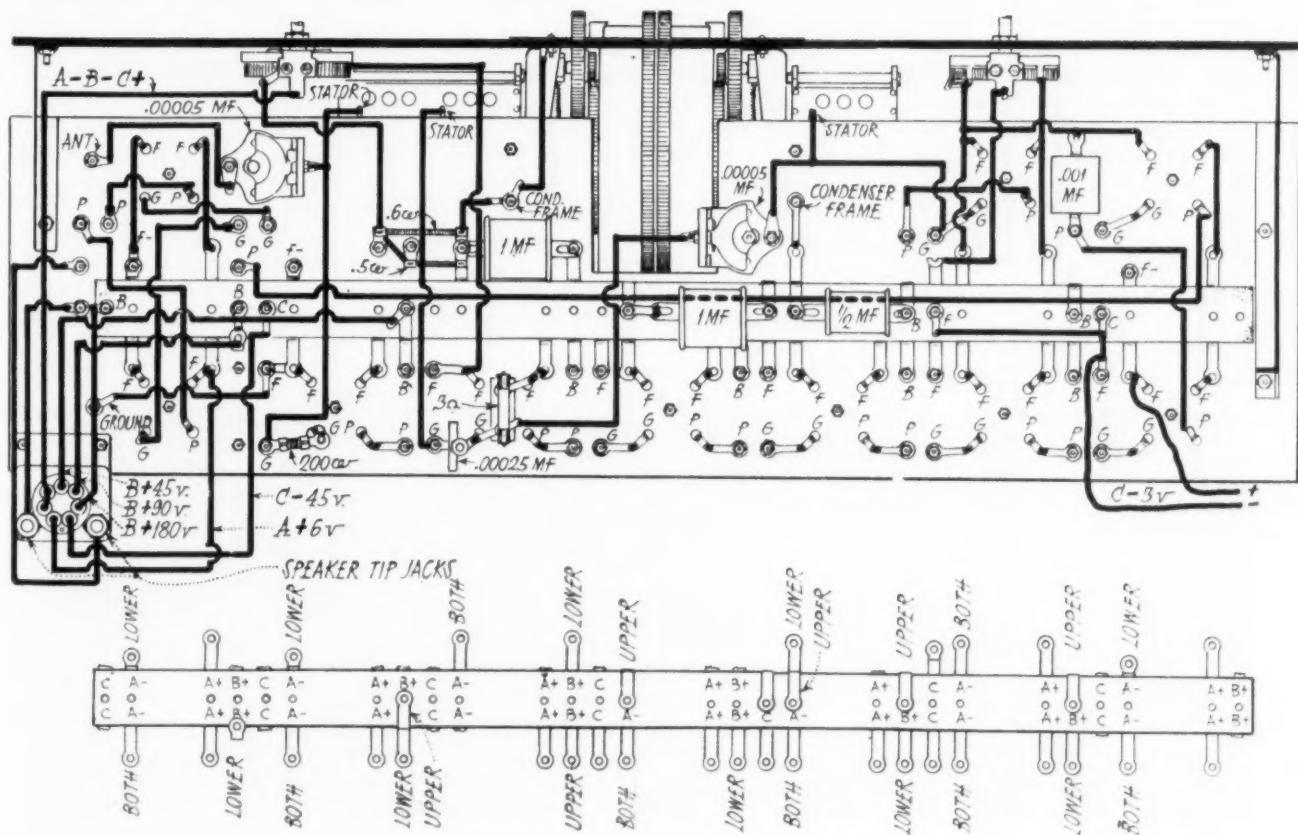
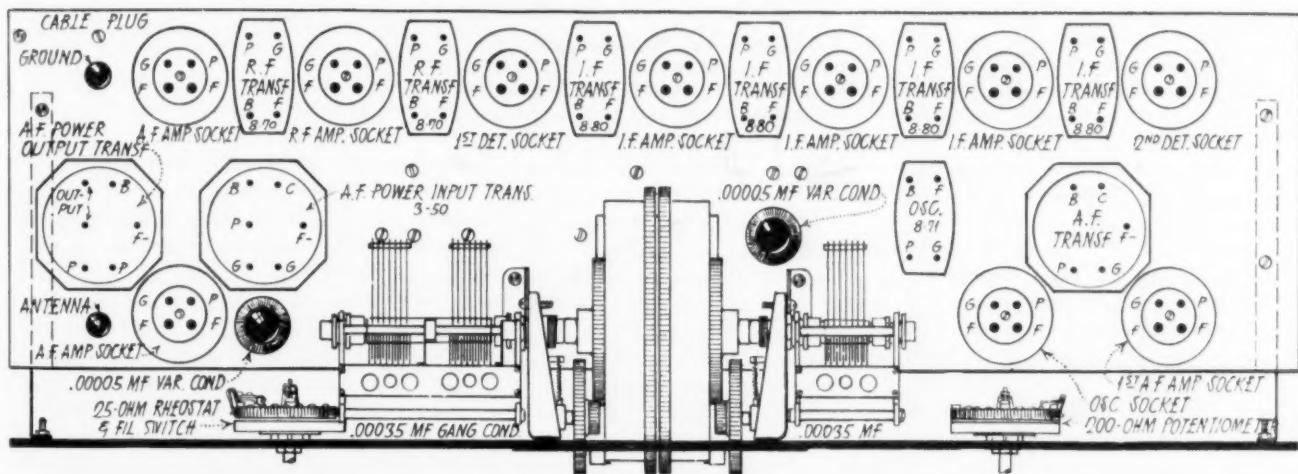


Fig. 2. Pictorial Wiring Diagram and Subpanel Layout.

through a 50 mmf. condenser, which is connected directly to the input coil and obviates the necessity of primary coupling of any sort.

A 200 ohm resistance in the grid circuit of the r.f. tube prevents oscillation at the short waves, and permits a fairly uniform amplification through the broadcast band, without requiring some sort of a sensitivity control of the r.f. tube. The r.f. transformer between the r.f. amplifier and the mixer is of the small, solenoid type, in a moulded bakelite case, and its inductance is so selected that it matches that of the antenna coil when the latter is connected to the average antenna, so that the two coils may be tuned by a twin condenser and single control.

The oscillator has fixed coupling, and is tuned by a single-gang .00035 mfd. condenser attached to the drum dial opposite the r.f. tuning control. The grids of the oscillator and mixer tubes are connected through a .00005 mfd. midget condenser, so that by proper selection of the condenser capacity, the right amount of oscillator voltage can be impressed on the grid of the mixer throughout the broadcast band.

The three 380 kilocycle transformers have fixed tuning, and are permanently adjusted, so that they are sealed into moulded bakelite cases of the same type as the oscillator coil and r.f. transformers, making an especially neat appearance in the assembly. The detector is of the grid-bias type, without grid condenser or leak, and has a C voltage of 3 volts negative, provided by a tap on the C battery.

The audio amplifier employs a new type of transformer, which amplifies uniformly from the extremely low frequencies (25 cycles or thereabouts), up to the top of the audio frequency scale used in speech or music (6000 cycles), and then drops in amplification sharply to cut off unwanted high frequencies which often come into the receiver in the form of squeals and heterodyne whistles from interfering stations or oscillating receivers in the neighborhood. The push-pull output transformer has

LIST OF PARTS FOR
TYRMAN TEN

- 2—Tyrman Type 8-70 R.F. Transformers
- 1—Tyrman Type 8-71 R.F. Transformer
- 4—Tyrman Type 8-80 R.F. Transformers
- 1—Tyrman Type 3-30 Audio Transformer
- 1—Tyrman Type 3-50 Power Input Transformer
- 1—Tyrman Type 3-51 Power Output Transformer
- 1—Tyrman Vernier Drum, Double
- 10—Tyrman Shielded Sockets
- 1—Kurz-Kasch Capacity Connector
- 1—7x26 in. Front Panel, drilled and decorated Bakelite
- 1—7x26 in. Sub Panel, Ivory Bakelite
- 2—Benjamin Brackets
- 2—Carter 1 mfd. Condensers
- 1—Carter $\frac{1}{2}$ mfd. Condenser
- 1—Carter .00025 mfd. Mica Condenser
- 1—Carter .001 mfd. Mica Condenser
- 1—Yaxley No. 669 Cable Connector, Complete
- 1—3 Megohm Resistance, with Mounting
- 1—Yaxley 6L Filament Resistance, 1 $\frac{1}{2}$ amp., 5 volts
- 1—Yaxley 5L Filament Resistance, 1 $\frac{1}{4}$ amp., 5 volts
- 1—Yaxley 200 ohm Potentiometer
- 2—50 mmf. Midget Condensers
- 1—Yaxley 25 ohm Rheostat with Switch
- 2—Binding Posts
- 1—Type 351 Camfield .00035 mfd. Condenser
- 1—Type 352 Camfield .00035 mfd. Two Gang Condenser
- 1—Yaxley 200 ohm Grid Resistance

been designed to carry heavy plate current flow, so that even the type CX-310 tube may be used if output greater than the 371 tube can give is wanted. In all audio transformers, the cores as well as the metal shields are grounded, and brought out to a separate terminal so as to facilitate grounding the transformers. By bringing out all transformer terminals at the bottom of the case, the transformer connections are all made underneath the subpanel, which is drilled with holes through which to pass the transformer terminal screws. In this way no connecting wires appear above the subpanel. This preserves the neatness of appearance which characterizes the set.

Filament control is unusually simple, the only rheostat being an adjustment to the mixer tube in the form of a 25 ohm variable resistance which does not need frequent attention. This rheostat contains the battery switch, so that the filaments are lighted as soon as the rheostat knob is turned. Fixed resistors take care of the voltage adjustment to all the other tubes in the circuit, so that no voltmeter or other variable adjustments are required.

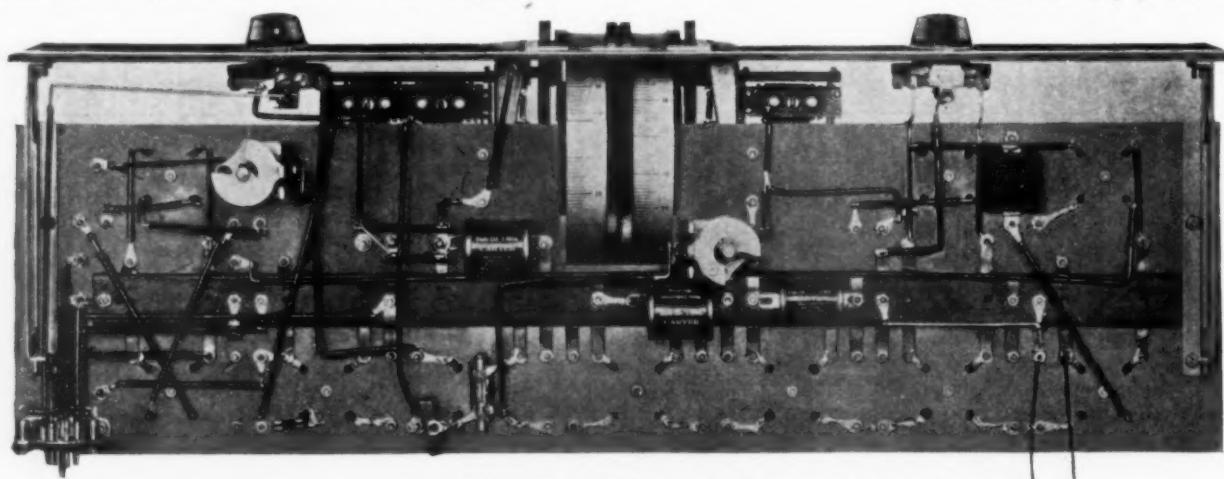
Volume control is obtained by connecting the grid return wires of the three 380 kilocycle amplifier tubes to the slider of a 200 ohm potentiometer, which is bypassed with a $\frac{1}{2}$ mfd. condenser as shown in Fig. 1. Bypass condensers are also connected across the sections of B battery which supply the r.f. end of the set, as well as the first audio amplifier, so as to prevent coupling in the battery leads and oscillation troubles which might otherwise result.

The tube sockets have metal shield cases which fit over the tubes after they have been placed in the sockets, and thus prevent any interaction between tubes or r.f. coils. A binding post is provided at the base of each shield, and flexible wires should be run to the binding posts of the r.f. amplifier and mixer tubes, from the ground connection. The remaining socket shields need not be grounded, but are left floating as a capacity shield.

In the list of parts is included all material needed to duplicate the set shown in the pictures. The panel and subpanel may be obtained already drilled for all apparatus, so that no panel drilling template is given. With the drum dial assembly comes a metal template showing just how to drill the panel for the dial, so that there will be no guesswork in installing the dial equipment. To the drum dial bracket on each side of the center are fastened two auxiliary brackets which are in turn fastened to the subpanel, thus providing rigid support for the latter in place of projecting wooden pillar posts underneath the subpanel which are customary in most sets.

In assembling the subpanel, all sockets and transformers are provided with terminals on the bottom so that all wiring is underneath the subpanel. The sockets have a single hole mounting, and the terminals are made long enough so that they can be passed through holes in the panel and bent over to be soldered to lugs fastened to adjacent apparatus. The transformers are fastened with nuts placed over the screws projecting through the panel, and the capacity con-

(Continued on page 50)



Bottom View, With Capacity Connector Strip in Place.

How To Service The Installed Set

The First of a Series of Articles for Systematizing the Work of the Radio Service Man

By B. F. McNamee

WHEN word is received that a set "does not work" the service man should try to locate and remedy the trouble when he inspects the installation in the owner's home. Only the most obstinate and obscure cases of trouble should be taken to the shop. It is most important, however, before leaving the shop, to check over the list of necessary tools, instruments and material in his portable repair kit, making sure that none of them is missing. The minimum requirements of such a kit are listed herewith. The nature and use of such of the contents as are not obvious is explained in the proper place hereafter.

Portable Kit Contents

Tools

Soldering Iron, with extension cord

Screwdriver, medium size

Screwdriver, narrow, for set-screws

Pliers

Wirecutters (preferably "diagonals")

File

Instruments

High Resistance Voltmeter, 0-500 volts

Continuity Tester

D.C. Ammeter, 0-5 amperes

Tube Tester

To locate the trouble, the service man can usually save time by following the definite routine outlined in the accompanying table of tests. These tests should be made in the order given, which is that of their usual frequency of occurrence. An experienced service man can sometimes see the cause of the trouble immediately, but the routine search is ordinarily the best.

Table of Tests

1. Test the filament voltage at the set and at the "A" battery terminals.
2. Test the plate voltage at the "B" battery or eliminator terminals.
3. Test the grid voltage at the "C" battery terminals.
4. Test the vacuum tubes.
5. Examine antenna and ground connections.
6. Remove the tubes, disconnect the batteries, and make the continuity tests as outlined hereafter.
7. Make complete visual inspection, looking for dirt, corrosion and loose parts, screws, dials and connections.

Measurement of filament voltage is made with the leads from the voltmeter in the continuity tester connected directly to the filament terminals of the detector or one of the a.f. sockets. See

that all filaments are lit, and then adjust the rheostat, if one is used, to obtain proper voltage. This should be 5 for the 201-A type tubes, 3 for the 199 type, or 1.1 for the 11 or 12 types. If there is doubt concerning the r.f. tubes, measure them in the same way. A rheostat is frequently used on the r.f. tubes to cut down the volume by cutting down the filament voltage; this rheostat should be varied while the measurement is being made.

If voltage at filaments is below normal, and cannot be brought up by the controls, measure voltage at battery, still with the filaments lit. Full battery voltage with low filament voltage indicates undue resistance between these points. In the case of storage batteries this is frequently in corroded contacts. It may also be in loose or dirty connections, or in a rheostat. See that the arm makes firm contact where it rubs. If resistance wire is not clean where arm rubs, use sandpaper.

Special directions are given later for measuring the voltage when the filaments are connected in series.

Measurement of plate voltage from B batteries is accurately accomplished with the voltmeter in the continuity tester. But when a socket-power B eliminator is used a high resistance voltmeter is necessary for accurate results. Approximate results can sometimes be secured by adding from 10 to 20 per cent to the reading of a voltmeter which draws 10 or 15 milliamperes. In the absence of a high resistance voltmeter this approximation may suffice for the amplifier tubes and the detector voltage can be adjusted so as to give best results on a distant station.

Tests of vacuum tubes are fully described in a forthcoming article in this series.

The continuity tester consists of a high grade voltmeter, two S.P.D.T. switches and two terminals, all mounted on a small bakelite panel. The panel is mounted on a box large enough to hold a 4½ volt C battery. The diagram of connections is shown in Fig. 1, which shows the terminals on the back of the voltmeter.

The voltmeter should be a high grade double-range instrument, 0-7.5, 0-150 volts, drawing not more than 10 or 15 milliamperes for full scale deflection. A high resistance voltmeter, such as is used to measure the output of B

eliminators, is not suitable for this purpose.

To use the tester as a voltmeter, throw the left switch to V and the right switch to A or B, according to the voltage to be measured. To use as a continuity tester, throw the left switch to C and the right switch to A.

The purpose of the continuity test is to show whether any of the circuits are broken. Wherever the table of tests does not suffice it should be remembered that each plate should show a continuous circuit to some B terminal and that each grid, except the detector, should show a continuous circuit to some C or —A terminal. These principles do not apply to grid circuits using a condenser and grid leak, as in some r.f. and a.f. amplifiers.

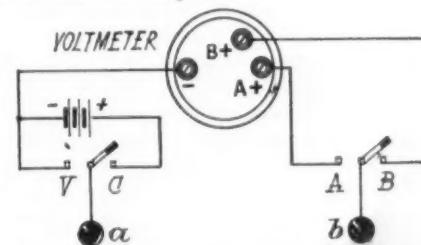


Fig. 1. Diagram of Connections for Continuity Tester.

For most work it is convenient to use the continuity tester with the two 4-ft. flexible leads having brass rods on the free ends. The lead is soldered to the brass rod, and the latter taped to within an inch or two of the end. Readings can then be taken easily from otherwise inaccessible points, such as the socket contact springs.

Localization of opens and shorts. If, for example, an a.f. grid circuit shows an open between the grid contact and —C, it may indicate an open transformer secondary, but it is not safe to conclude that this is the case without making the continuity test at the transformer secondary terminals. A connection may be broken at the socket, or a connecting wire broken inside the insulation. After locating the circuit which is open, each portion of it should be tested separately until the particular point is found.

Resistance measurements may be made with the continuity tester if the resistance of the voltmeter is known. (This may be obtained by connecting the voltmeter in series with a milliammeter and battery from the equation:

Resistance (in ohms) = $1000 \times \text{volts} \div \text{milliamperes.}$) If E_1 is the volt-

Table of Continuity Tests

CONNECTIONS "a"	"b"	CORRECT READING	REMARKS
Ground	Antenna	Full	Zero indicates open antenna coil, except where series condenser is used.
—A	—A in each socket	Full	If zero, look for open switch or rheostat.
+A	+A in each socket	Full	If zero, look for open switch or rheostat.
—A	Grid in R.F. sockets	Full	Zero indicates open grid coil, except C battery is used on R.F. grids, when "a" should be moved to —C. On sets using grid resistors, the reading will be partial. Any other reading indicates shorted grid condenser.
—A	Det. grid	Zero	Zero usually indicates open transformer secondary. On any grid which uses no C battery, place "a" on —A.
—C	A.F. grids	Partial	Zero usually indicates open transformer primary.
+B Det.	Det. plate	Partial	Zero indicates open circuit through primary of R.F. transformer.
+B Int.	R.F. plates	Full	Some sets do not connect B Int. to 1st A.F. plate; if reading is zero, try B Pos. or +B Pwr.
+B Int.	1st A.F. plate	Partial	Reading will be zero if loudspeaker or output transformer is not connected or burned out.
+B	Plate of last A.F. or Output tube	Partial	Full reading indicates shorted bypass condenser or short in cable or wiring, or short between primary and secondary of some R.F. or A.F. transformer.
+B Int.	—A or +A	Zero	Partial reading, even very small, indicates "leaky" bypass condenser. A good bypass condenser will usually show a sudden swing of the needle at first, but the needle will immediately return to zero.

"a" and "b" are the terminals of the continuity tester indicated in Fig. 1. Remove tubes and disconnect batteries before making tests. A "partial" reading is any reading greater than zero but less than the full voltage of the battery.

age reading when terminals *a* and *b* are connected, E_2 the voltage reading when *a* and *b* are connected through the unknown resistance *X*, and *R* is the resistance of the voltmeter, then $X = [R(E_1 - E_2)] \div E_2$. This method is not practical for measuring very small or very large resistances, such as a rheostat or a grid leak.

Corrosion or dirt should be cleaned, removing with sand paper if necessary. The solder on the end of the tube prongs should be brightened in order to stop noises that are due to the poor contact caused by the insulating film on the solder.

Other Specific Troubles

Whistling, when not due to heterodyne between stations, may be due to non-neutralized r.f. amplifiers, "low-reading" tubes, or excessive *B* battery resistance. The tubes should be tested as described later, new batteries should be tried, and the set should be neutralized with the same tubes as are to be used in receiving. The methods of neutralizing will be explained in a subsequent article.

Audio frequency howls, similar to that produced by holding down one key of an organ, may be caused by a high resistance *B* battery, a poor connection, or a worn-out *C* battery. But usually they are due to the mechanical action of the sound vibrations from the loud speaker on the tubes, particularly the detector. These vibrations shake the tube, and cause it to make the same sound in the loud speaker as it does

when tapped with a pencil, except that the action and resulting sound are continuous. Loud speaker vibrations may reach the tube through the air, or, when the loud speaker rests on the same cabinet or structure as the receiver, they reach the tube through vibration of this structure. Hence this trouble often occurs in sets having built-in loud speakers. In other cases the howl can usually be stopped by moving the speaker away from the set a few feet.

Temporary relief can be obtained frequently by moving the tubes around until the one which is least microphonic is in the detector socket. But this cannot be considered permanent, as tubes may become more microphonic through use.

The most satisfactory remedy for this trouble is a tube cap, which adds considerable weight to the top of the tubes. If the cap is loose it will be of little use; it should hug the glass.

In some cases it is sufficient to use one of these caps on the detector tube only, while in other cases it will be found necessary to use them on several tubes. The last a.f. tube is insensitive to these vibrations (because they are not further amplified before getting to the speaker) and needs no weight. R.F. tubes are microphonic only when there is a wave from a station tuned in, or when they are allowed to oscillate. In these cases the loud speaker vibration tends to modulate the r.f. current.

Distortion and hollowness of sound may occur from the same causes as listed above. When howling occurs it is

a case of a.f. oscillation; if the same causes are present, but fall short of producing a.f. oscillation, they will produce a.f. regeneration. This latter acts to greatly emphasize certain frequencies, which depend on the natural periods of the tubes and loud speaker, and on the frequencies most favored by the amplifying system. When one listens at a distance from a receiver having this fault, the predominance of some one note in the music is easily noticed. Apply the same remedies as above.

Intermittent operation, starting and stopping without apparent cause, may be due to an intermittent current supply or to a loose connection. Make the tests previously outlined, at the same time moving or shaking the wires or parts involved in each test.

Continuous crackling noise is often attributed to static, or to faulty power lines. To determine its origin, disconnect the aerial and if noise continues undiminished it is due to noisy or fluctuating *A*, *B* or *C* voltages, or to a loose connection. Frequent causes of such noise are unsoldered connections in the aerial and imperfect ground connection.

Common causes of noise are soldering paste and dirt on insulating parts, loose laminations in transformers, and loose condenser plates (including fixed condensers). These troubles can usually be found by visual inspection more quickly than by any other method.

Noisy controls may be caused by faulty pigtails, use of oil on bearings which are intended to carry current, dust between condenser plates, or rubbing of condenser plates. Pigtails which consist of bare ribbon should be adjusted so that the turns never touch each other. Dust between condenser plates can be removed with a pipe cleaner.

Lack of selectivity may be due either to an unfavorable location close to a broadcaster or may be an inherent fault of the set. Greater selectivity may often be obtained by shortening the aerial, although this correspondingly decreases the volume. A fixed condenser, .0001 mfd. or less, in series with the aerial has the same effect. The ground connection should be as short as possible. The selectivity of some sets can be improved by attachments especially designed for the purpose. An unwanted station can be shut out by means of a wave trap.

The use of more than a single straight wire for aerial is apt to broaden the tuning without increasing the volume. Use of any of the various "trick" aerials and grounds are apt to make matters worse instead of better. While such special aerials and grounds which are advertised to perform wonders may be made and sold in good faith, the opinion of most engineers is that they are simply catch-penny affairs.

(Continued on page 81)

The Misfire

By Paul Oard

HERE were several separate and distinct reasons for the dislike that Dawson, veteran member of the detective force, felt for Raule. In the first place, Raule was a young squirt, not much beyond his teens, almost beardless of face, and altogether insignificant in his physical makeup, especially so in comparison with Dawson, who was built along the lines of a true dick, heavy stature, big feet, and the general makeup of the metropolitan detective. Altogether, Raule looked as little like a detective as did Dawson, by sheer contrast, give the impression of filling every inch of the part.

Another reason, and a really vital one, was that Raule was a correspondence school sleuth. He hadn't grown up with the force, breaking in first with the police department, and then by reason of special adaptability taking a transfer into the plain clothes squad. But he had dropped into headquarters bright and early one morning, diploma in hand, a well polished star on his vest, and a nice shiny pair of cuffs in his pocket.

To the vast astonishment of the force, he had remained. Captain Matty, chief of the squad, not given to talk, had chosen to keep his silence as to why Raule had been placed there, taking precedent over veteran members. Back of his silence lay a story of daring and persistence upon the part of Raule, that had other members of the force known, would have done much toward establishing him, even with the hard-boiled Dawson, who dealt fairly in conclusions as he made them. But Matty, watching for some evidence of self praise in Raule, and biding his time before he would finally pigeon-hole Raule in his mind, kept his peace, while Raule, bearing in mind correspondence school lesson Number Seven, The Successful Detective in Ten Lessons, sawed wood and boasted not.

Searching back in your memory, you may recall the story that flared across the front pages of Pacific Coast dailies, when a number of trucks, heavily laden with a choice and assorted selection of European and Canadian booze, were seized after a running battle in which automatics spoke vigorously one to the other, and only the overturning of a truck prevented a machine gun from going into action. The public never did get the low down on the affair, of how Raule, living in a sea-coast town, poring over his correspondence course in sleuthing, the while a headset clamped



Jerking the receivers from his ears, he whipped a pistol from his pocket and jumped from the car.

over his ears as he studied, picked up the weak buzzer signals of the rum runner as she lay some fifteen miles out, and piecing together, partly through knowledge picked up along the waterfront, and partly through intuition, information that certain government operatives would give much to know. Then Raule with canny foresight and a well founded distrust of the local officers, made the wires hot to Washington, where a certain official, inducted into the Raule family line through marriage, set machinery in prompt and sudden motion.

The thrill-loving public got a lot of good reading, various editors argued the cons and pros of prohibition, especially the pros, certain parties lost much sleep and more money, and Raule, who managed to squirm into the final grand melee, came out of the fracas with two black eyes, two broken ribs and a sprained ankle. All of which resulted in his joining Captain Matty's squad. True, wires were pulled to place Raule there, but it was Captain Matty's decision after hearing the story, that settled the matter finally.

ONE morning, some months after Raule's assignment to the force, Captain Matty was closeted with Dawson, rapidly sketching Dawson's next job. The tip had come in that the liquor ring was to land at a new spot on the coast, south. On a road map of the coast line, Matty indicated the spot where, according to tip, the landing was to be made, a somewhat impossible point for the purpose except in calm weather. Here the road dipped from the bordering hill land directly to the beach, following it for a distance of a half mile or so. A landing once made, transportation was a simple affair by truck. Dawson's part was to be a strictly under cover affair, as he was be-

ing secretly loaned to the government operative force.

"As you approach the Jensen ranch, which you will find clearly marked at the lane which leads from the coast road," said Matty, indicating a point on the map, "the road dips sharply down the side of the hill to the beach. As you start down the grade, you are to put out your lights, as though a fuse had blown, stop and examine them from in front of the car, turn on your spot light and proceed on down grade. What I mean is, rather, Raule will get out and examine them—now never mind, listen! Raule is new and unknown yet, while your face and shape are too well marked to take any more risk than necessary.

"Your car will proceed down the grade, follow the road along the beach and continue on up grade further. About half way up, beyond the first curve, and hidden from sight of the beach, is a cluster of live oak and brush, hanging over the road. At this point Smith, a government operative, will board the car with as little fuss as possible, riding on over the hill. You will park your car on the other side, go back on foot with Smith, who will take you to the officer in charge for further orders.

"I am sending Raule with you because he is not known. He will be dressed as a chauffeur. Your car will be a Packard sedan, and you are to play the part of the owner on a trip. It is very possible that you will be stopped, under some pretext, before you reach Smith, and be given the once over. As you will be in the back seat it will be hard to identify you if you work it right. I understand that lookouts have been posted to forestall a possible surprise, but the prohibition men have been in place a short distance back of

(Continued on page 56)

Chart for Finding Great Circle Distances

By W. C. Osterbrock

IN THESE days of long distance radio communication and plane flights there is frequent occasion for rapid determination of the distance between two places widely separated on the earth's surface. The shortest distance between two such points is the great circle passing through both of them. This is the route followed by a radio message and the one which planes try to follow.

While these distances can be measured correctly along the surface of a globe, great errors are introduced when measured on a flat map. Representation of a curved surface on a plane causes more or less distortion. Hence, in the absence of a suitable globe, recourse is generally had to spherical trig-

onometry. But this takes time and also has the chance of error.

Consequently the accompanying chart was developed to overcome these difficulties. It has been in use at 8CAU-8YX for more than two years and in that time it has demonstrated its time saving possibilities. It is a nomograph or straight line diagram which graphically solves the usual sine and cosine formulae used in spherical trigonometry.

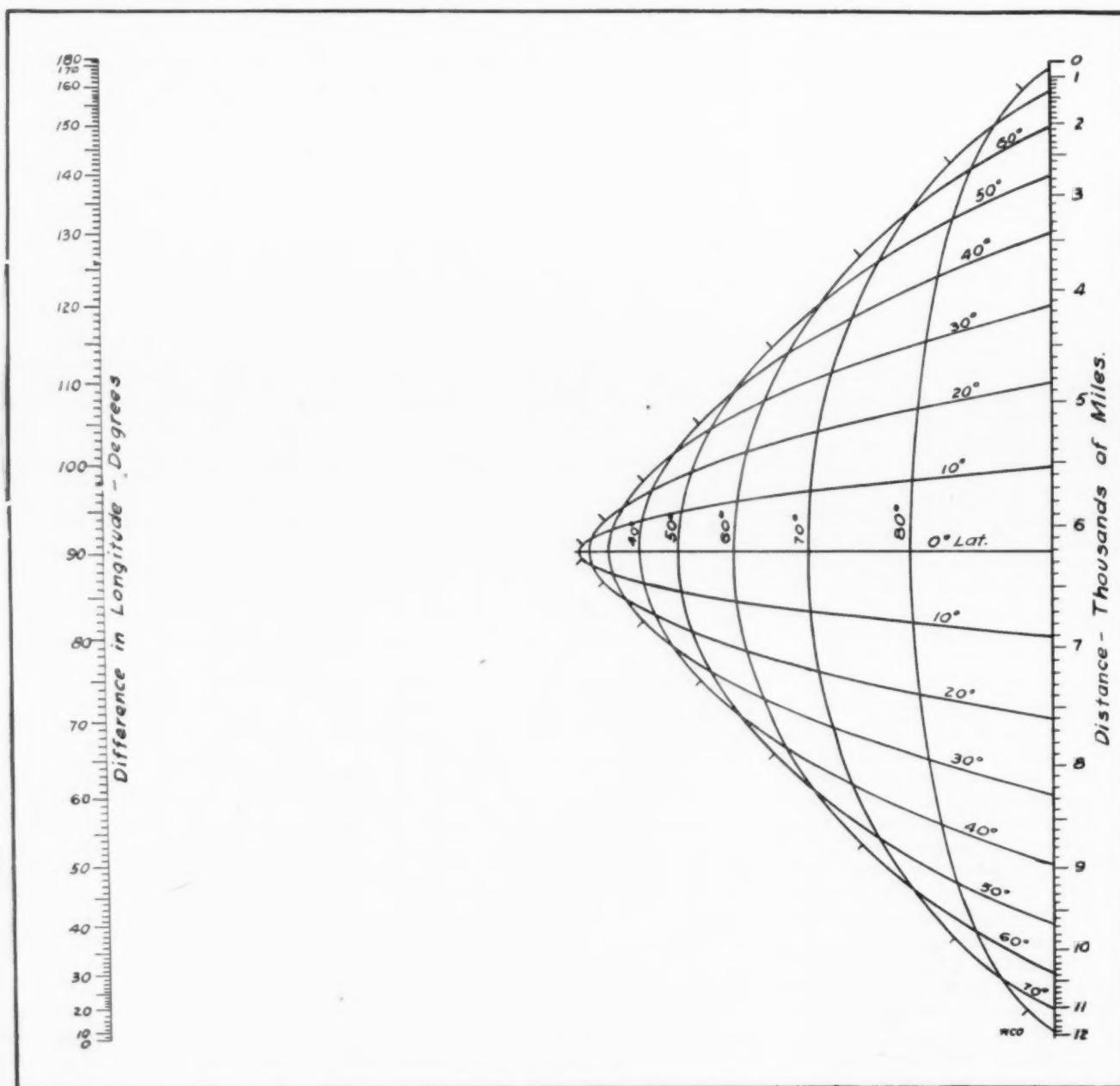
Its use is best illustrated by means of an example. Suppose that one of the places is at Lat. 40 degrees North, Long. 80 degrees West, and that the other is at Lat. 10 degrees North, Long. 30 degrees East. The first step is: find the difference in longitude, which is 110 degrees in this case. Locate this point

on the left hand scale of the chart.

The next step is to find the intersection of the two curves marked 40 degrees Lat. and 10 degrees Lat. respectively. Connect this intersection by a straight line to the 110 degree graduation on the left-hand scale, and the prolongation of the straight line will indicate the distance in miles on the right-hand axis. In the present example the distance is approximately 6800 miles.

It will be noticed that the curves for 40 degrees and 10 degrees Lat. have two intersections. The one lying above the middle of the chart is to be used when, as in the example worked, both points lie in the northern hemisphere or both are in the southern hemisphere.

(Continued on page 32)



Socket Power Operation of the Magnaformer 9-8

By G. M. Best

MUCH interest has been manifest in regard to the group of *ABC* eliminators described in June and July *RADIO*, and their adaptation to standard receiving set circuits ordinarily wired for battery supply. As a practical example of how the change may be accomplished, the Magnaformer 9-8 receiver described in the September *RADIO* has been redesigned for use with any one of the *ABC* power units using the Raytheon Type BA 350 millampere tube, and with the filaments of all tubes except the power tube wired in series.

This change requires very little rearrangement of the apparatus and of only about half of the wiring, the remainder being left intact, since the grid and plate leads, as well as the *B* battery supply leads, are the same for either battery or *ABC* socket power operation. In Fig. 1 is shown the revised circuit, while the power plant to which it is best adapted is shown in Fig. 2.

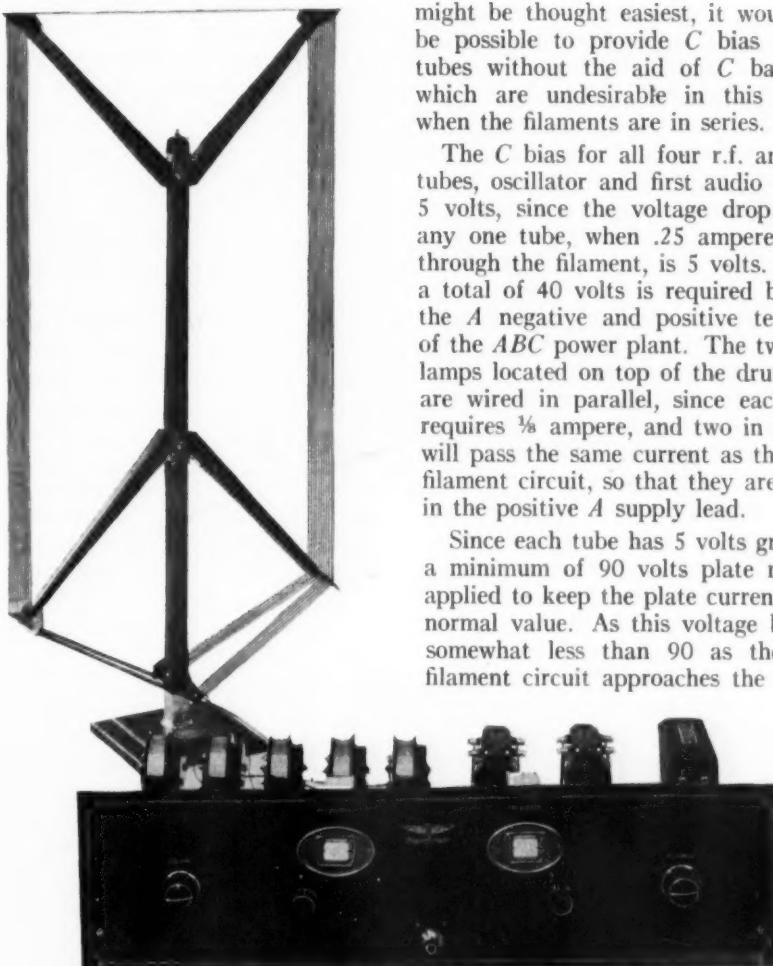
In the original Magnaformer layout, there were seven type *A* tubes, drawing .25 amperes each at 5 volts, one type 112 and one type 171 power tube, the latter two comprising the audio amplifier. In the new arrangement, the first audio tube is replaced with a type *A*, and all eight *A* tubes are wired with their filaments in series, starting at the negative end of the *A* supply at the negative end of the second detector filament, and ending at the positive *A* supply with the positive filament of the first audio amplifier tube.

The filaments are wired in an irregular order, so as to enable the obtaining

might be thought easiest, it would not be possible to provide *C* bias for all tubes without the aid of *C* batteries, which are undesirable in this circuit when the filaments are in series.

The *C* bias for all four r.f. amplifier tubes, oscillator and first audio tube is 5 volts, since the voltage drop across any one tube, when .25 amperes flows through the filament, is 5 volts. Thus, a total of 40 volts is required between the *A* negative and positive terminals of the *ABC* power plant. The two pilot lamps located on top of the drum dials are wired in parallel, since each lamp requires $\frac{1}{2}$ ampere, and two in parallel will pass the same current as the series filament circuit, so that they are placed in the positive *A* supply lead.

Since each tube has 5 volts grid bias, a minimum of 90 volts plate must be applied to keep the plate current at the normal value. As this voltage becomes somewhat less than 90 as the series filament circuit approaches the positive



Magnaformer 9-8, Wired for "ABC" Eliminator Service.

of *C* bias voltage for each tube from the voltage drop across some other tube in the circuit. If the tubes were connected in series in a uniform row, as

end, the grid bias voltage in some cases is slightly high for the effective plate voltage, but not to an objectionable amount. In view of the fact that it is

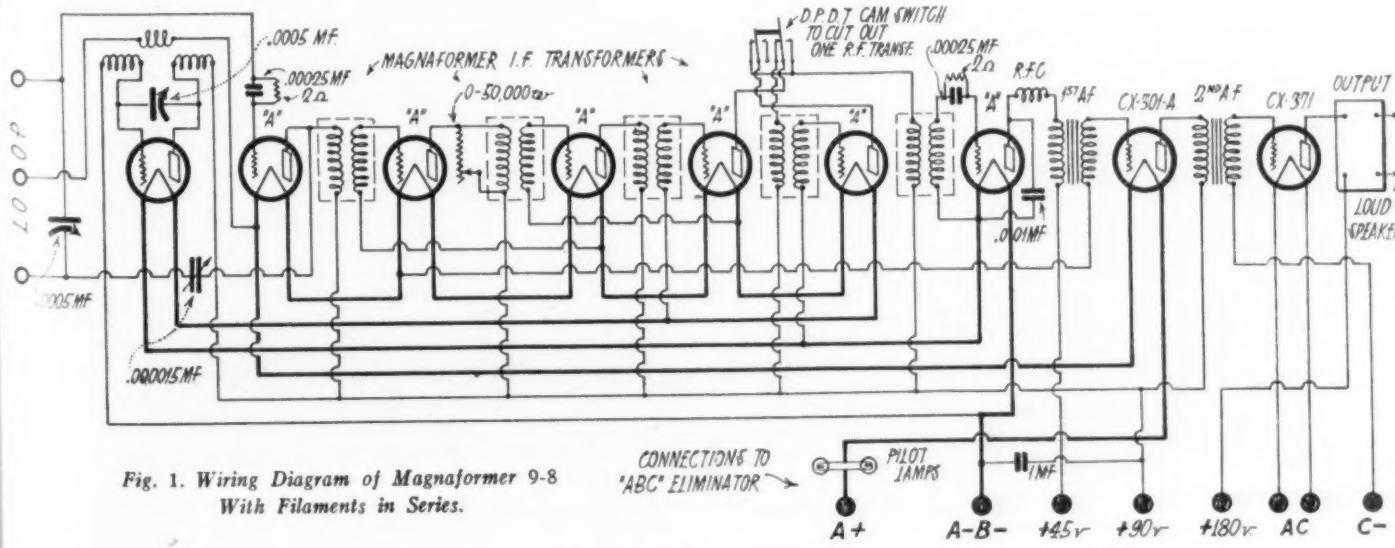


Fig. 1. Wiring Diagram of Magnaformer 9-8 With Filaments in Series.

not possible to control the volume in the r.f. amplifier by means of a 400 ohm potentiometer, as is done with the battery operated Magnaformer set, some other method of volume control was found necessary, and a 50,000 ohm variable resistance connected across the primary of the second r.f. transformer proved to be satisfactory. Another method would be to shunt the filaments of the first two r.f. amplifier tubes with a 200 ohm potentiometer, so connected that the resistance across the tubes could gradually be lowered to zero, so as to by-pass the current and thus lower the amplification to the desired amount. This has the disadvantage of sometimes causing the r.f. amplifier to oscillate uncontrollably, due to the change in impedance when the tube filaments are cut out of the circuit.

The filament of the power tube is operated from a.c., which is brought to the set through a twisted pair, such as a piece of lamp cord, so that there will be no a.c. hum introduced into the set through the filament wiring. The grid return of the power tube is connected to the negative C terminal of the cable connector plug, and by reference to Fig. 2, it can be seen that the C

LIST OF PARTS FOR MAGNAFORMER 9-8 ABC OPERATION

- 1—Formica front panel, 7x26x3/16 in.
- 1—Formica sub-panel, 9x25x2/16 in.
- 5—Magnaformer Transformers, Unit R.F. No. 61
- 1—Unicoupler, Unit C. U. No. 71
- 1—Remler No. 110 drum type dial with control
- 1—Remler No. 110-R drum type dial with control
- 2—Remler No. 649, .0005 mfd. variable condensers
- 9—Benjamin sockets, No. 9044
- 2—Benjamin sub-panel brackets, 2 in. high No. 8629.
- 2—Ferranti audio transformers, A.F. Nos. 3 or 4
- 1—National tone filter
- 1—Samson radio frequency choke coil No. 125
- 2—Aerovox grid condensers, .00025 mfd., with mountings, Type 1475
- 1—Aerovox .001 mfd. fixed condenser, Type 1450
- 1—Aerovox 1 mfd. by-pass condenser, Type 200 short
- 2—Durham 2 megohm grid leaks
- 5—Frost tip jacks
- 1—Yaxley cable connector plug No. 660
- 1—Yaxley radio jack switch, No. 60
- 1—Electrad 50,000 ohm variable resistance
- 1—.000015 mfd. midget variable condenser
- 2—Feet Acme bus bar wire, No. 14 round tinned
- 25—Feet Acme flexible spaghetti covered wire
- 1—Quali-Tone loop—Duro Metal Products Co.
- 1— $\frac{1}{2} \times \frac{1}{2} \times 2$ in. wood block for sub-panel support
- 2—2 in. right angle supports for rear of sub-panel
- Screws, lugs, nuts, solder

voltage is obtained by the voltage drop across the 150 ohm potentiometer, through which the filament and plate current of the entire receiving set

passes. The slider is varied until the correct amount of C voltage is had; where meters of high resistance types are not available, a milliammeter having a scale of at least 0-50 milliamperes should be placed in the positive 180 volt lead, and the C voltage varied until the plate current reads 20 to 25 milliamperes.

For data on the actual construction of the ABC power plant, see the various models described in July 1927 RADIO. As the series filament circuit requires no rheostats or potentiometers, the four Frost rheostats used in the battery model need not be used, although the combination rheostat-filament switch may be left on the front panel, and the switch connected directly across the negative and positive A terminals. When the set is not wanted for a short time, and yet the power plant is to be left running, the filaments can be shorted out with a turn of the rheostat knob, and the set put out of service. No harm to the power plant will result from this procedure, and it is a handy use for the switch.

In the November issue of RADIO, data will be given for operating the Magnaformer 9-8 with the new a.c. tubes.

The hum caused by the 60 cycle magnetic field from the power transformer and the first filter choke in a B eliminator may sometimes be stopped by covering them with a copper or brass box. The second choke should be outside of this box. The space between these three several parts should be at least 2 in. Each should be placed in the position of least magnetic coupling with the other.

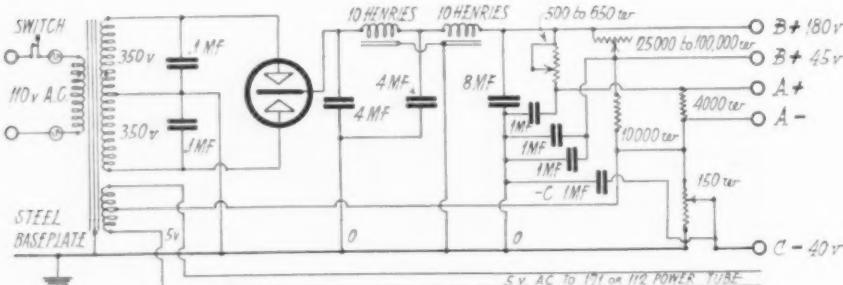
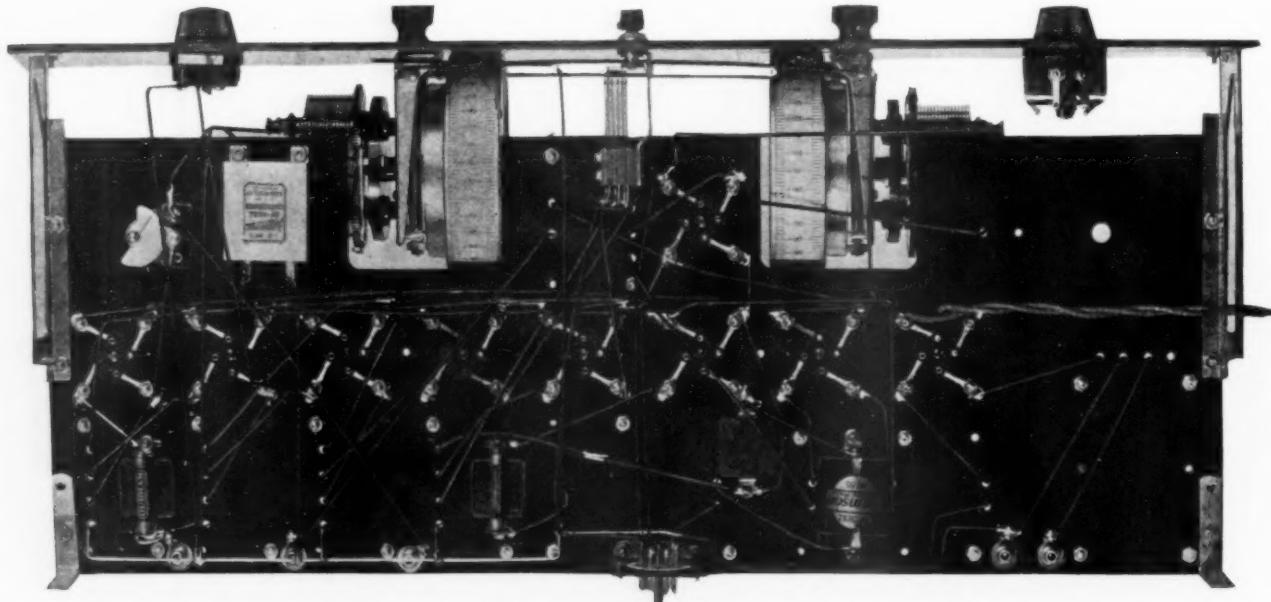


Fig. 2. "ABC" Eliminator Circuit for Magnaformer 9-8.



Bottom View of Sub-Panel, Showing Wiring Required for Series Filaments.

The Radio Ground Connection

A Simple Description and Comparison of Various Kinds of Grounds and Counterpoises for Receivers

By Charles F. Felstead

PROPER ground connections for radio receiving sets play as important a part in long distance reception as does the aerial. Maximum distance cannot be obtained otherwise. The ground connection is really one plate of the large condenser formed by the ground and the aerial. If we have a poor aerial and a fine ground, we cannot expect maximum results, any more than if we have an excellent aerial and a faulty ground connection.

A good ground is particularly desirable with a crystal set, because maximum efficiency is necessary to get good results with a small set. In transmitting, too, a low-resistance ground connection, either a counterpoise or a direct connection to the earth, is all important to secure the greatest possible transmitting range.

The old reliable stunt of connecting the ground wire to a water pipe is the easiest ground connection to install, and it is about as good as is necessary for ordinary reception. The cold water pipe is to be preferred. A connection is usually made to the part of the pipe that approaches nearest to the receiving set by scraping it thoroughly with a file to remove the dirt, and then sandpapering it until the surface is shiny. If a ground clamp that straps around the pipe is used, a piece of heavy lead-foil, or tea-foil, can be wrapped around the cleaned part of the pipe, and the ground clamp put over the foil and tightened. A good ground clamp can be purchased cheaply at any radio store, and is far better than a connection made by winding the ground wire around the pipe. One type of ground clamp has a pointed screw that bites into the metal pipe when it is tightened. It is excellent because it makes an almost perfect contact with the pipe.

The ground lead can be a No. 12 enameled or insulated copper wire, soldered to the ground clamp, and run directly to the ground binding post on the receiving set. The ground lead should be insulated, not to keep it from coming in contact with the earth in this case, but to prevent it from becoming oxidized, which would greatly increase its radio-frequency resistance. The ground lead does not need to be held away from the wall on porcelain insulators, unless it is the ground lead for the lightning arrester, and it is held away from the wood in that case to prevent fire, should lightning strike the

aerial. The ordinary receiving ground lead can be fastened directly to the wall with insulated wire staples or ordinary tacks.

It is difficult to solder the ground clamp to a water pipe as long as there is water in the pipe; but, if the amateur insists on having it soldered, he can turn the water off at the main valve where the pipe enters the house, and, by opening all the faucets in the house, run most of the water out of the pipes. Soldering to the pipe is not so hard then if an extra-large soldering iron or blow torch is used. A soldered connection to the pipe is the best, of course, but it is usually more trouble than it is worth.

In most cases, a connection to a gas pipe makes a very poor ground. Set owners who are having trouble in getting good reception with their radio sets had best look to their ground connections; for a defective ground can cause an excellent receiving set to work very poorly. If the trouble-giving set is grounded to a gas pipe, it will usually be found that by changing the ground connection to a cold water pipe the trouble will clear up. Gas pipes do not make good ground connections because they are insulated by a rubber coupling hose where they enter the gas meter. This is to prevent lightning running to ground by way of the gas pipes and setting fire to the gas, in case the building is struck by lightning. Since the gas pipes usually do not enter the ground until after they have passed through the gas meter in the house, a gas pipe ground acts only as a poorly insulated counterpoise, and so has a high resistance. Hot water piping is sometimes insulated at the heater in the same manner as the gas piping is insulated.

Sheets of metal, driven pipes, metal boilers, lengths of junk copper or iron wire, and any other sort of metal buried 2 ft. or more in damp soil will make a good ground connection. This type of ground is superior to a connection to a water pipe if the soil is moist and deep. Dry or sandy earth, hardpan, or alkali do not allow a good earth connection to be obtained for radio reception, as their resistances are high; and, in that case, a counterpoise, either insulated or uninsulated, would be better. A good buried metal ground can be made by digging a hole 4 to 6 ft. deep in damp earth and throwing in all the pieces of scrap metal obtainable. Copper wires should be soldered to each piece of

metal and run directly to the ground binding post on the receiving set. If bare wire is used for the lead and is run under the surface of the earth to the set, it will act as part of the ground system.

It is necessary that the earth around the metal be kept moist for best results; so a length of 2 in. pipe long enough to project several inches above the surface of the earth is often stood upright in the hole before the dirt is put back. When the earth dries out, it can be moistened by pouring water down the pipe. A quantity of rock salt or coke is sometimes put in the hole around the metal for the same purpose. The salt or coke draws the moisture out of the surrounding earth and retains it, keeping the ground continually damp. Several patented grounds are merely copper plates fastened in perforated wooden boxes and surrounded with charcoal. Old copper pans and tea kettles are good to use in the buried metal type of ground connection.

A multiple ground connection, which may be made by connecting the leads from several different grounds together, will give excellent results in most cases.

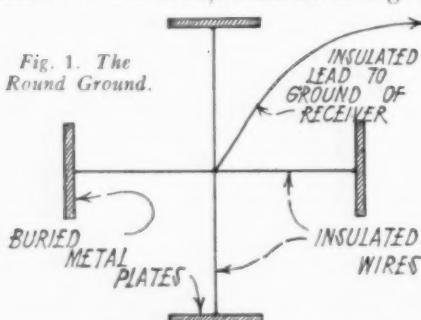
If a metal pipe is not handy, a substitute ground connection can be obtained by connecting the ground lead to one of the screws that hold a metal electric light switch plate, or light socket plate, to the wall. A similar type of temporary ground connection may be obtained by attaching the ground lead to the side of the electric light wires that is grounded. These ground connections are merely substitutes, and are not to be used if any other ground is available. The steam radiator or the bed springs in a hotel room may be used for the ground connection. An insulated or bare wire, 25-ft. or more long, laid on the surface of the earth as nearly under the aerial as possible, or hung from an upstairs window, forms a good ground connection for a portable receiving set. A piece of metal, or a length of copper wire, placed in a lake, stream, well, or the ocean is a ground connection that is hard to beat, and is excellent for a portable or permanent installation.

The Round Ground

ROUND'S "round" ground, invented by Captain H. W. Round, chief engineer of Marconi, Ltd., London, is without doubt the best form of actual earth connection that can be obtained. In this system a circle 10 to

20 feet in diameter is made on the ground, and at four or more points on the circumference, sheets of metal are buried from 2 to 6 ft. in the ground. From each sheet of metal an *insulated* wire is brought along the surface of the earth, or just below the surface, to the center of the circle, as shown in Fig. 1.

Fig. 1. The Round Ground.



Heavily-insulated, weather-proof wire must be used for these leads. If plates of metal are used, they should be stood on edge in the trench. All of the leads are brought together at the center of the circle and fastened to an insulator mounted on a post set in the ground; and a heavily-insulated lead wire brought from this post to the binding post on the receiving set. A better way to bring the leads to the center of the circle is to support them several inches above the earth on insulators fastened to wooden posts beside the plates. All connections should be carefully soldered. With this type of ground connection, the ground wire lead must be as carefully insulated as the aerial lead-in, for the whole secret of the unusual results secured with it lies in the insulation of the leads.

The resistance of Round's ground is much less than the resistance of the ordinary multiple earth connection. This is due to the fact that in a multiple ground, which is made by joining a number of different buried metal grounds to one lead, a little of the radio energy leaks off at each separate ground connection along the ground lead; instead of entering the earth all at once as it does in the Round ground. This gradual leakage of the radio energy in the multiple ground has the same effect that resistances added to each of the ground connections except the first would have; and resistance is the one thing that we do not want in the ground connection, or in any other part of the radio installation. In Round's ground, the energy reaches all of the earth connections at the same instant; and there is no slow leakage, if the leads have all been carefully insulated. This ground connection, like all other types, should be as directly under the aerial as possible.

The Counterpoise

WHILE the counterpoise is not very generally used for receiving, it is so efficient that it will be discussed in detail here. There are

two main types of counterpoise; the insulated and the uninsulated types. An insulated counterpoise is usually constructed exactly like the aerial with which it is to be used; and is suspended directly under the aerial and close to the ground. Sometimes the counterpoise is constructed like a horizontal fan; and other times it takes the form of a flat-top aerial. The counterpoise and the lead from it must be as well insulated as the aerial and the aerial lead-in, with this type of counterpoise.

A good flat-top type of receiving counterpoise can be made by fastening two copper wires to 3 ft. spreaders, and suspending it from 6 to 10 ft. off the ground and directly under the aerial. This counterpoise can be from 25 to 75 ft. long. Insulators must be put in the ends of the wires. Four or six wires can be used, and would be a trifle better. The counterpoise can be of either the L or T type; in other words, the lead can be taken at one end of the counterpoise, or from the center. The lead from the two wires should be insulated carefully and connected to the ground binding post on the set in the usual manner. All connections must be soldered.

Another form of counterpoise is known as the horizontal fan type. In this counterpoise, three or more wires are fanned out radially like the spokes in a wheel from a point near the aerial pole to a large spreader about 50 ft. away. The wires should be separated about 5 ft. at the "free" or far end. It may be suspended 5 ft. or more in the air, and insulators must be connected in the end of each wire. If a wood spreader that is long enough for the far end of the aerial is not available, two poles can be placed at the proper distance apart, a strong wire stretched between them, and the counterpoise wires fastened to this wire. Instead of putting the insulators in the ends of the counterpoise wires in this case, they may be put in the ends of the spreader wire. An insulated lead can be connected to the counterpoise at the point where the wires join. A good counterpoise will give much better signal strength in a receiving set than an earth ground, even better than a round ground, but it has a tendency to make the receiving set tune somewhat broadly.

If the aerial has only a single wire, a two-wire counterpoise is the best to use; although a single-wire counterpoise that is a duplicate of the aerial would be satisfactory. Enamelled wire and Pyrex, porcelain, or glass insulators should be used for the counterpoise. If there is no room in the yard for the counterpoise, it can be run the length of the cellar, and fastened to the beams by porcelain knob insulators. Two-foot wide chicken wire can be used in place of the copper wires.

The uninsulated type of counterpoise,

which is often formed of several lengths of bare copper wire laid directly on the earth underneath the aerial, is not so efficient as either the Round ground or the insulated counterpoise, but it has the advantage of being easily and quickly installed. The wires can be radiated out like the wires in the insulated fan counterpoise. Another form of uninsulated counterpoise, which is very much like a buried metal ground, can be made by burying bare copper wire several inches under the sod. The wire can be buried easily by making a cut in the sod with a spade and forcing the wire down into the cut. Several buried wires can be radiated out fanwise for about 100 ft. from the receiving set. Chicken wire, or metal screening can be buried under the sod in a like manner, and presents more surface to the earth; although it requires the removing and replacing of a considerable quantity of turf. This type of ground connection is quite efficient.

GREAT CIRCLE DISTANCE

(Continued from page 28)

The intersection lying below the middle of the chart is used if one of the stations is in the northern hemisphere and the other in the southern. Thus, if the second station had been located at 10 degrees South, 30 degrees East, the lower intersection of the curves marked 10 degrees and 40 degrees would have been used, and the distance would then come out 7720 miles.

In the actual use of the chart it will of course be necessary to doubly interpolate between the curves. It is suggested that the user of the chart draw in permanently a curve representing his particular latitude; then a single interpolation will suffice in all cases.

There still remains the possibility that two stations will have the same latitude, or equal latitudes in different hemispheres. In such cases the proper point to use for intersection of the latitude curves is indicated by a short stroke attached to the curve in question near the boundary of the network. Thus, if the second station had been at the position 40 degrees North, 30 degrees East, the distance would have been about 5380 miles.

In order to determine the distance between two points on the earth's surface, it is of course essential to know the positions of the points. The most convenient way of stating these positions is by means of their latitudes and longitudes, and in the case of radio stations, this information is frequently of value in other applications, such as skip-distance experiments, extent of the daylight region at any particular time, etc. The writer believes, therefore, that all QSL cards should include the geographical position of the station as an important part of the data.

How To Test Radiola Catacombs

Directions for Building and Operating A Continuity Tester of Inaccessible Radio Receiver Circuits

By Edward T. Jones

THE testing outfit here described has been designed to give a visible record of tests of sealed catacombs in sets which the trade normally return to the factory because necessary testing instruments are not available locally. This outfit is particularly useful for testing Radiola catacombs as well as other receivers whose parts are inaccessible. It is practical, simple, and inexpensive, costing less than ten dollars. It is used in connection with a special work sheet prepared from a schematic wiring diagram of the set. Sheets for various Radiola models are presented herewith. Its principle of operation is based upon the sensitivity of a glow lamp, such as the UX874, as an indicator of circuit continuity or discontinuity.

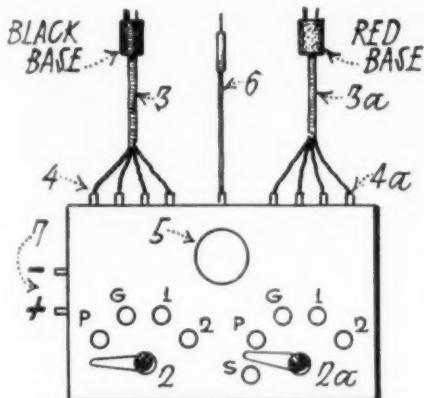


Fig. 1. Pictorial Diagram of Test Box.

The general arrangement of parts is shown in Fig. 1 and the wiring thereof in Fig. 2. The dimensions of the box

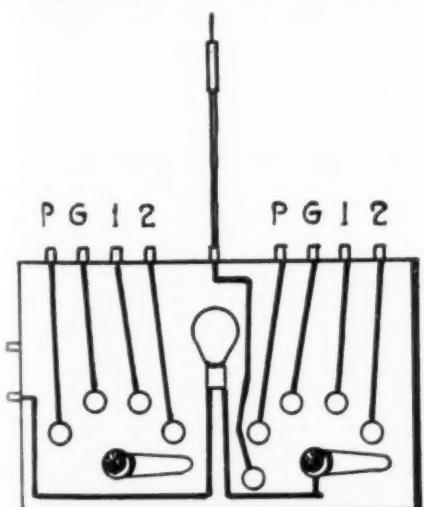


Fig. 2. Wiring Diagram of Test Box.

are left entirely to the constructor. It is necessary to provide a hole in the top of the box to permit the top of the glow lamp to protrude so that the glow will be visible when conducting tests. The cabinet can be constructed to house the glow lamp and enough space provided for mounting the two switches, or it can be made large enough to house six No. 468 Eveready 22½ volt B batteries which furnished the 135 volts for the glow lamp.

One of these lamps, connected as in

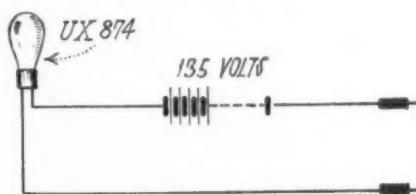


Fig. 3. Glow Lamp Connection.

Fig. 3 is more sensitive as a voltage indicator than the best volt meter. The lamp will glow if the two test clips are lightly held in each hand. With this test it is possible to get a faint glow through the grid-leak tests on catacombs. Never before has it been possible for us to obtain this particular test otherwise. The UX-874 Radiotron fits any standard or UX socket.

In the pictorial diagram of Fig. 1, 1 is the panel, 2 is four-point rotary

switch, 2a a five point rotary switch, 3 and 3a are four-line test cables provided with UX199 bases, 4 and 4a are each four binding posts which may be used with cables equipped with other than 199 bases, 5 is the glow tube socket, 6 is an auxiliary cable and test clip to be attached to switch point 3 for special tests, and at 7 are binding posts for connecting external batteries. Cables 3 and 3a fit into the sockets of the radio sets being tested.

The letters and numerals on the switch contacts and corresponding binding posts are P for plate, G for grid, 1 and 2 for filament leads. In a wiring diagram of a Radiola the polarity of the filament leads is reversed for each socket. The test sheets are marked with the numerals instead of the polarities.

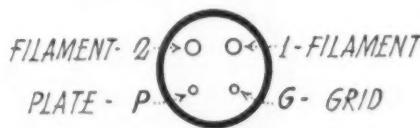


Fig. 4. Socket Connections to Cable.

Fig. 4 shows the connections to the bottom of the UX199 tube which is soldered to the cable. To distinguish these bases one should be black and the other red, the red being frequently shifted in following the procedure outlined in the test sheets.

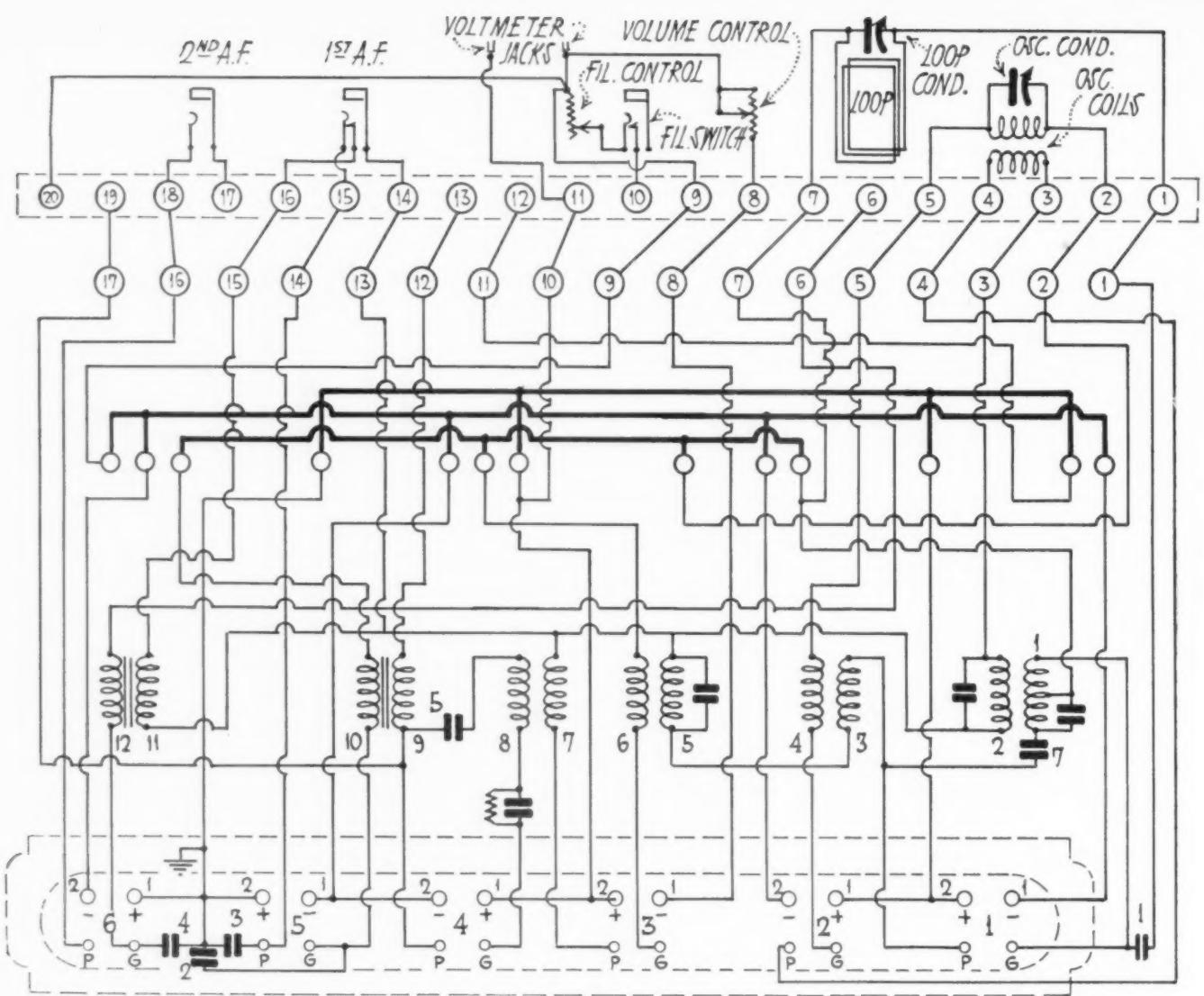


Fig. 5. Continuity Diagram of Radiola No. 25.

This procedure is best illustrated by actual examples. Fig. 5 is the continuity diagram of a Radiola 25 and Table I is the test sheet to be used with it. As trouble is most likely to develop in the audio circuit the audio coil tests are marked with X so that they may be made first and possibly obviate the necessity of making the others.

In order to test coils 9 and 12 it is necessary to use the special test clip 6. This is due to the fact that the circuits end at terminals 6 and 13 on the terminal bars when the battery cables strips are released in order to remove the panel from the cabinet for test. Other tests than shown can also be conducted, such

as testing the volume control resistance unit, from 1-1 to 3-1, from the negative filament in socket No. 1 to the negative filament connection in socket No. 3.

The test sheets and continuity diagrams for the other models are self-evident. In each case the audio circuits are indicated by X.

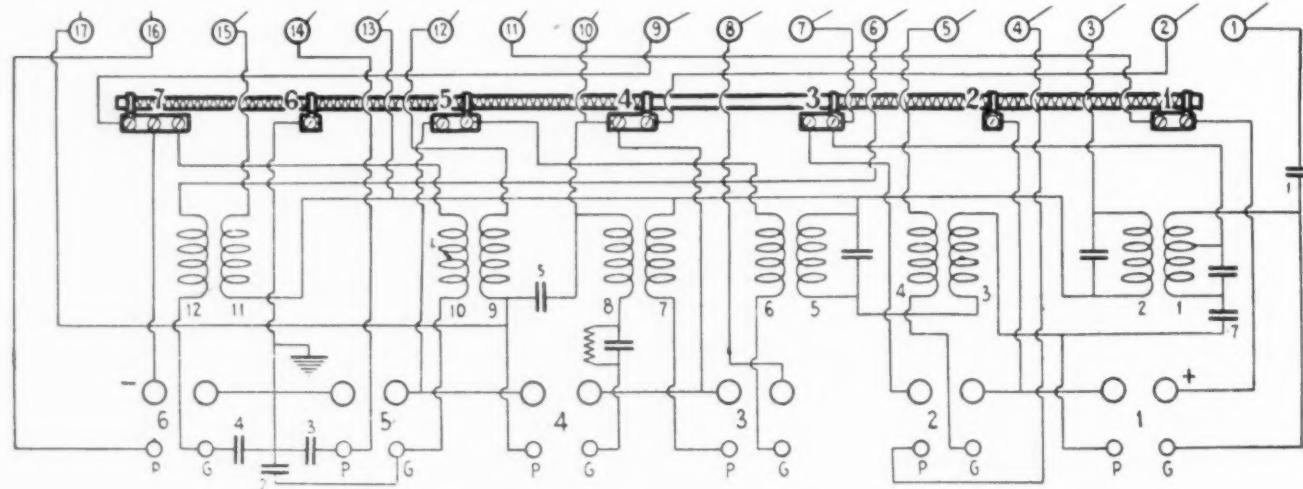


Fig. 7. Continuity Diagram of Radiola No. 28 Catacomb, D.C. Operated.

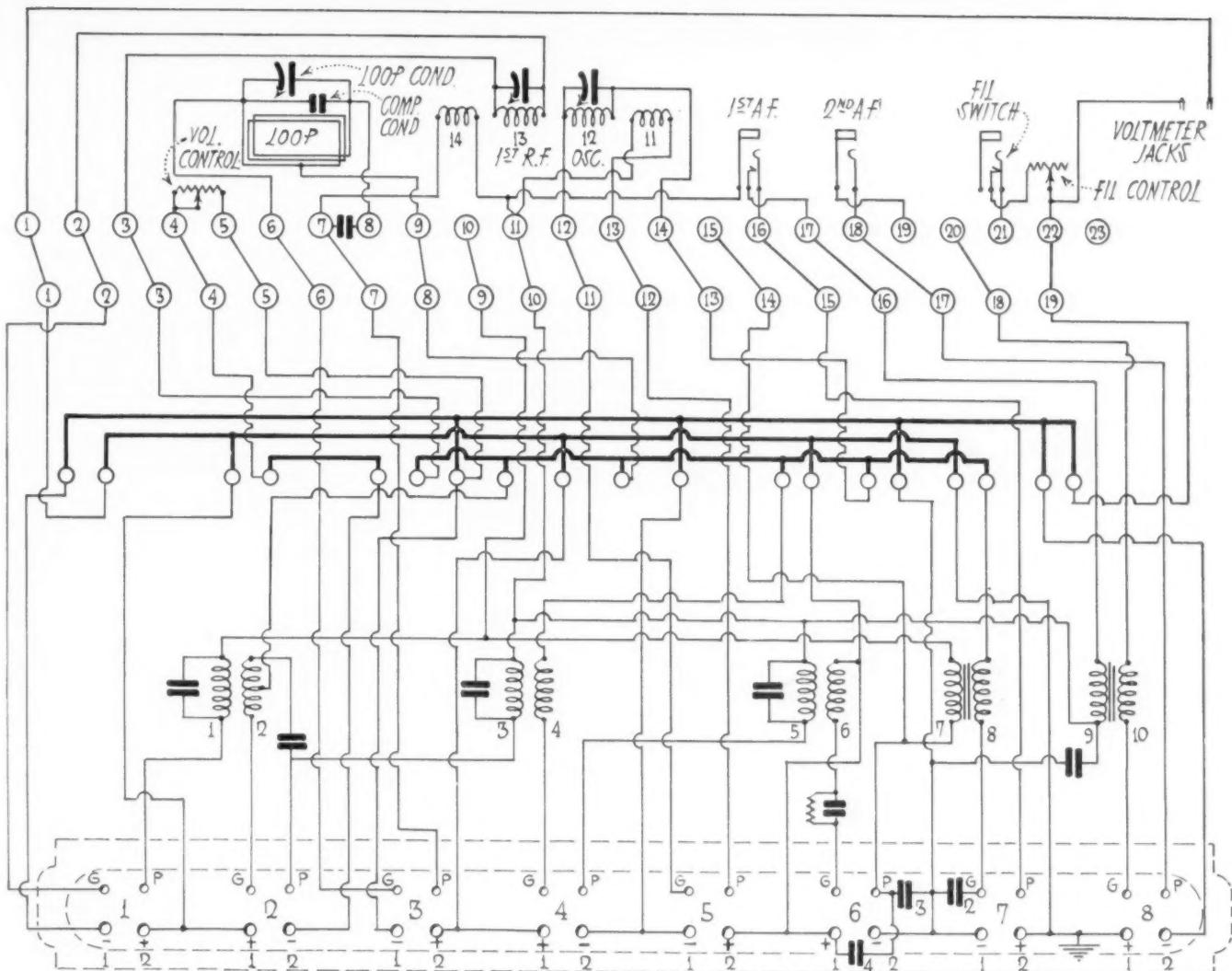


Fig. 6. Radiola 25 A.C. Operated Continuity Circuit Diagram. (Use spare terminal No. 6 in conjunction with Table III.)

By closely studying these circuits and then tracing the test sheets it will be very clear as to how the writer arrived at the tests. You, too, can take the wiring diagram of any receiving set and dope out your own test sheets for that particular model. When this is done, add it to your test book, and finally you will find it a pleasure to test radio receiving sets instead of a lot of confusion.

(Continued on page 76)

SOME NEW NEMA STANDARDS

Distortion, as defined by the Nema Handbook of Radio Standards, is "a change in wave form." Such changes may be introduced in passing through either a circuit or a transmission medium. Thus fading, or the variation in signal intensity resulting from changes in a transmission path becomes a form of distortion. A circuit which introduces in the output wave frequencies which were not present in the original wave is one cause of distortion. Another cause is the difference in transmission efficiency at different frequencies within the waveband; this changes the relative amplitude of the component frequencies.

TEST SHEET NO. 1 FOR RADIOLA NO. 25 CATAcomb

BLACK In Socket Number	BASE Switch Contact Number	RED In Socket Number	BASE Switch Contact Number	CORRECT INDICATION	OTHERWISE TROUBLE AS INDICATED BELOW
1	G	2	G	Lights	Coil 4 or oscillator coil open
1	G	3	G	Lights	Coil 6 open
1	P	3	G	None	Condenser 7 shorted
1	P	3	P	Lights	Coils 2, 7 or oscillator coils open
1	2	4	P	None	Condenser 5 shorted
1	2	4	G	None	Grid condenser shorted
1	2	5	G	None	Condenser 2 shorted
X1	G	5	G	Lights	Coil 10 open
1	2	5	P	None	Condenser 3 shorted
X1	P	5	P	Lights	Coils 3, 5 or 11 open
1	2	6	G	None	Condenser 4 shorted
X6	G to terminal six on back of terminal board using test connector No. 6				
X4	P to terminal 13 on back of board as above				
				Lights	Coil 12 open
				Lights	Coil 9 open

A third cause of distortion is a change in the relative phase of the component r.f. frequencies. This does not cause distortion in audio-frequency waves.

The Nema standard term for a condenser is a *capacitor*. It is defined as a device used in a radio circuit to introduce the element of capacitance. It is standard to mark on individual boxes or cartons the minimum and maximum capacitance of variable capacitors in

micro-microfarads. It is not standard to indicate their size by marking on the carton the number of plates.

In the five pin base for a vacuum tube employing an a.c. heating element the Nema standard does not approve of the use of the word *filament* in referring to the heater elements. The approved designation for the two heater plates is *H*, for the plate pin *P*, for the grid pin *G*, and for the cathode pin *K*.

Coloring and Finishing Metals

By Samuel G. McMeen

THE simplest method of blackening iron and steel is also one that gives a fine result. This method is to coat the iron or steel with ordinary lubricating oil and heat it in the Bunsen flame until the black coating forms. On cooling, the coating will be found to adhere tenaciously and to resist abrasion. If you want the color of the deepest possible blackness, oil the steel again and reheat it, when the coating will be still better adapted to withstand wear.

The oil is such as is used for lubricating machinery, including automobiles. Hence it is of mineral origin, usually a product of petroleum distillation. But, oddly enough, lard oil does just as well, and it is possible that other animal oils are suitable. Fish oil does well, but has a bad odor.

This seems an appropriate place to introduce the side thought that lard oil is not the proper lubricant for tapping and threading brass. The right material for that purpose is soapsuds.

The standard United States government method for browning steel objects, such as guns, is one in which a solution of certain chemicals reacts with the steel and produces a coating which is afterwards protected by an outer coating of gum or dried and oxidized oil. Dissolve in 2 qts. of warm water 2 oz. (avd.) of copper sulphate, 3 oz. (avd.) bichloride of mercury, 1½ fluid oz. nitric acid, 3 fluid oz. tincture of iron, 3 fluid oz. sweet spirits of nitre, and 3 fluid oz. of alcohol.

Thoroughly clean the steel object in a hot solution of lye, made of one part of concentrated lye to eight or ten parts of water. Wash the piece after the caustic bath, wipe it dry, and rub it with steel wool, grade 00. It should now be uniformly bright.

Then apply the solution above described with a wad of absorbent cotton. Let the solution dry on and continue its action for twenty-four hours. It will then be found to have formed a fine rust wherever applied. Rub the surface again gently with the steel wool. Apply a second coat of the solution, drying and acting a whole day as before, followed by another rubbing with the steel wool and by this time an application of either clear celluloid lacquer, shellac lacquer (in which case the metal should be warmed before its application, to prevent the lacquer from setting cloudy), or boiled linseed oil.

The celluloid lacquer is composed of celluloid dissolved in amyl acetate or "banana oil." Such lacquer can be had at all paint stores under one or another trade name, but if only a small quantity be needed, it can be made by dissolving a photographic film in amyl acetate. The gelatine coating of the films should first be washed off with hot water.

For a brown color on steel that requires no outer protecting covering, the copper coating process is good. It also prevents rust. The copper coating can be applied by electrically plating in a bath, or by swabbing with a saturated solution of copper sulphate. When this application is made, the iron seizes the sulphuric acid of the sulphate of copper and leaves the copper free to deposit itself on the iron. We say "on the iron" and not "on the steel" because that is the chemical truth of the matter. The iron is what reacts, the carbon or tungsten or whatever else is present having no part in the interchange. When the copper coating is in place, swab or flow it with a saturated solution of ammonium sulphate, giving it a good brown color. Obviously the method is wholly suitable for solid copper articles.

Brass, bronze, bell metal, or copper can be readily given an intensely black, glossy finish which is durable under heavy wear by first cleaning it in the hot lye bath, rinsing, and then heating over a charcoal fire or Bunsen flame, *in the open air or under a well-drawing hood*. It is then dipped into a solution of 4 fluid oz. of saturated solution of copper nitrate and 2 fluid oz. saturated solution of silver nitrate, dissolved in 6 fluid oz. of water. Drain the work over the jar containing the solution and heat again. Wash off the fluff with a wet brush. Repeat the heating and dipping in the solution as before. Again the wet brush. Then dip for five minutes in a solution of ½ oz. liver of sulphur in 16 oz. water. Drain and reheat, then brush again, and the finish is complete except that a trace of floor wax and a rub with a woolen cloth will add luster.

A great variety of colors is possible with varying proportions of colored lacquers. To get the finish applied, for example, to brass microscopes, dissolve 1 oz. of bleached shellac in a pint of alcohol. Let it settle thoroughly and pour off the clear top part. Color this with resin dragon's blood, which is red. A very little of it will give the golden tint seen in fine brass work. Vary the

amount of dragon's blood to get shades to your taste.

For a clear yellow lacquer, gamboge is an excellent coloring material. Turmeric, with a little gamboge, gives a good green. Annatto, turmeric and saffron can be combined with good results into a gold.

In using lacquers of all sorts, the first and chief requirement is that the metal shall be spotlessly clean before the coating is applied. This can be done by using the lye bath to remove all grease, following this by "pickling" in a bath composed of one part of nitric acid to twenty parts of water. The resulting surface is free from oxide, and if smooth enough for the finish, nothing more need be done. The two operations, which are not too welcome to most workers on account of the corrosive nature of both solutions, can be sidestepped by buffing the metal. A buff wheel is made of a plurality of round cotton cloths sewed together. Buff first with tripoli, and then, *on another cotton wheel*, with rouge. Never let the two buff-wheels get mixed. Mark them in big letters, "Tripoli" and "Rouge." The former abrades and the latter polishes.

There is a form of finish for metals of all kinds that is not a coating but is a marking of the actual surface. It is damaskeening, and can be done with great ease by anyone who has a tool that goes around. Even the homely hand drill will do in a pinch, but the drill press is best, and the lathe second best. This finish is often seen on the brass and nickel parts of the movements of watches, and when evenly done is most attractive.

To do it, chuck in the drill press a round stick of wood, charge the free end of the stick with tripoli or very fine emery or carborundum, and bring it down firmly against the metal while the press runs. The abrasive will brighten a spot into a pleasing iridescence, whereafter one brightens another spot close by and so continues till the surface is covered. The spots may be placed in a fixed geometrical pattern or be laid on haphazard. The size of the spots will depend on the taste of the mechanician, but in general the larger the surface to be viewed, the larger the spots may well be. In small work they may be as little as a sixteenth of an inch in diameter.

(Continued on page 68)

An Electric Phonograph Pickup

Complete Directions for Constructing the Unit and Connecting It To A Radio Set and Loudspeaker

By Carl J. Penther

ANYONE owning an old style phonograph and a radio set with a good audio amplifier and loudspeaker can readily convert the phonograph into a new style electrical instrument by making a pickup unit from a phone unit. Electrical reproduction of the record depends upon causing the needle vibrations to generate a variable voltage which may be amplified sufficiently to operate a loudspeaker. This may be accomplished by reconstructing a Baldwin phone unit.

After unscrewing the cap from the phone, the unit may be lifted out and the cord removed. Next remove the drop of solder from the driving pin at the center of the diaphragm, and unscrew the small washer holding the driving pin to the diaphragm. Care must be taken to see that this is *unscrewed*; it is actually threaded and cannot be removed without injury to the unit unless care is taken. After this, the diaphragm can be taken off, and the three rivets which hold the magnets to the aluminum frame can then be removed, also. The screw which holds the binding posts may also be loosened at this time.

We may now turn our attention to the old phonograph reproducer. After removing it from the arm, the first thing is to loosen the actuating lever from the diaphragm. From this point on, the procedure will be evident from the construction of the reproducer and will vary with the different makes. When the parts are all removed, it will be necessary, in every case, to obtain the bar holding the fulcrums for the actuating lever. This can generally be done by heating it hot enough to melt solder, as they are most always "sweated" on to the diaphragm holder.



View of Completed Pickup Unit.

After we have all our constituent parts from the two units, it is necessary to look them over carefully to see just how we are going to reassemble them into the new unit. From the photograph and sketches in this article you may see how the job was done in one case with one type of phonograph reproducer for a foundation.

instruments will dictate the exact arrangement). This piece is then drilled to conform with the three holes previously tapped in the magnet, and also with the other hole shown which is for mounting in the case.

The piece having the fulcrum is located as shown in the sketch and soldered in place. It will probably have been noticed by this time that the lever from the reproducer will fill the bill in its new use, but it is really quite simple to construct another from a finishing nail by heating and hammering, and the plentiful and careful use of a fine toothed file. It should be made approximately as shown in the sketch, and it will be found that it will act admirably in its new role. It is fastened to the needle holder by riveting the end in the hole provided for it in the holder.

At this time, the phone unit can be fastened to the brass plate by means of three machine screws. The needle holder with the lever is then fitted on, and the

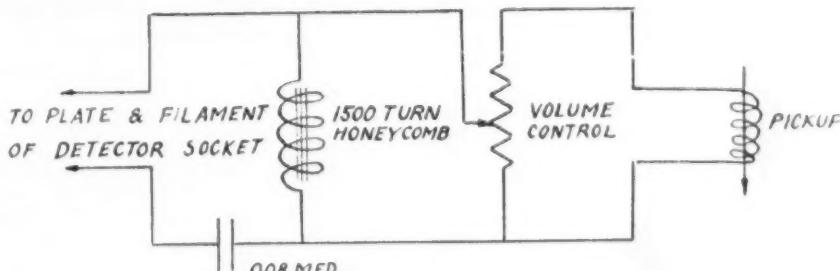


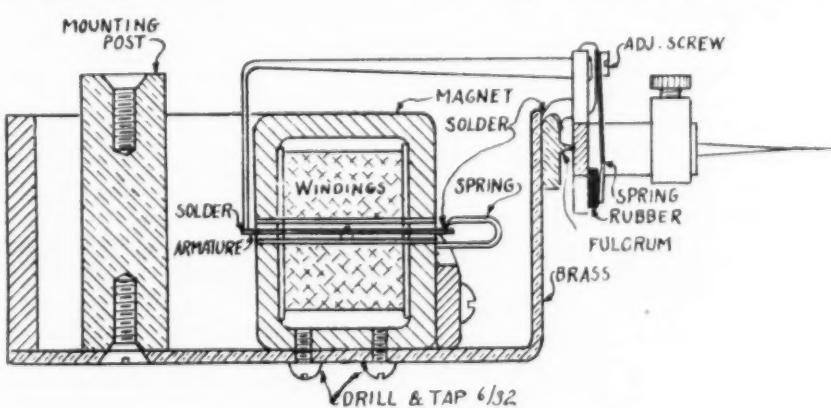
Diagram of Pickup Connection to Radio Set.

Referring to the cross sectional view, it is seen that the piece which held the rivets has been redrilled and tapped to take a 6-32 screw. A heavy sheet of brass or copper (old plates from the engraver's were used in this case) about $1/16$ in. thick is bent to the approximate shape and size shown, (your own

lever bent near the end so that the tip rests in the hole in the armature from which the driving pin was removed. After cutting to the proper length, the tip is fastened to the armature with a small drop of solder. It is also well to place a small drop of solder to fasten the spring at the other end of the armature. By adjusting the tension screws on the needle holder, the lever can be set as desired. Our hardest work is now done, the remaining part being to fit the unit to the phone case.

A slot is cut in the case and a circular piece of brass is made the diameter of the case, drilled, the whole is then screwed to the case, and the job is done. Some of the phonograph reproducer backs are about the same size as the phone case, so it is merely necessary to screw them directly to the case, greatly simplifying the job. A hole is drilled in the back of the case conforming with the hole in the mounting post

(Continued on page 72)



Cross-Sectional View of Unit's Construction.

Direct Communication

By Gilson V. Willets

"O H! So YOU are the wireless operator? My gracious! Don't they have a radio on this ship? What! They are both the same. You don't say! How interesting! How much would it cost me to send a message to New York? Oh! About twenty words or so. FOUR DOLLARS! Why, that's downright robbery . . . I shall speak to the captain. Did you ever meet my husband? He is the president of the Fifth Avenue Club, you know. No? Why, I thought everybody knew my husband. No, I don't think I'll send a message today. (Pause for breath) Oh! This is so exciting, it's my first voyage at sea, you know. Do tell me how you send the messages to the shore. Do they travel faster than the boat? Why can't I see them go? What! You really mean they travel 186,000 miles a second. . . What! Young man, you are trying to trifle with me. I am the Mrs. Henry Thornagle Vandusen. I shall report your insolence to the captain at once."

A grilling like this had lasted for the past half hour in the radio shack aboard the old KVL, long since burned at sea but at that time the pride of a great eastern coastal steamship company. A poor miserable radio operator, penned in his coop of a shack, had been the objective of this linguistic one-sided battle and he now sat back in his swivel chair, perspiration streaming off his aching brow and a look of helpless resignation spread all over his youthful features. The speaker was the most important passenger aboard the KVL and orders had been issued to show her every courtesy (which meant that she could do as she pleased regardless of regulations), but there were limits to human endurance. Any old timer who has passed through a barrage of questions in the old days with such a character as Mrs. Henry Thornagle Vandusen, will well remember the occasion by the finger nail scars in the palms of his hands.

Suddenly an inspiration came like a ray of sunshine to the miserable operator and he leaned forward with a most inviting expression towards his loquacious visitor, asking, "Have you visited the whole ship, madam?"

"Oh, gracious! Yes! I have been everywhere upstairs but the engineer officer promised to take me downstairs tomorrow before we reach Charleston. I'm terribly curious to see the cellar and the engines and pumps and all that, you know, etc., etc."

A mischievous smile stole over the operator's face as he put his next question. "When you were aft, I mean on the deck in the back of the ship, did you notice a long line trailing in the water behind the vessel?"

"Oh, yes! The officer said it was a tariff log, whatever that is. I was called away at the time and didn't hear the rest of what he was saying. Why do you ask?"

"Well, I'm going to let you in on a very closely guarded secret and you must promise not to breathe one word to anybody because if you do it will probably cost me my job. Promise? Good! Now listen; they tell you that those wires up there between the masts send out the wireless messages to shore, but I am sure that anyone of your intelligence realizes that such nonsense is impossible. Now, don't be shocked; it's a fact! Yet, we do communicate with shore. You see, it's this way, that line behind the ship is a wire and it connects directly with this key and these instruments here. When we left New York yesterday, that wire was attached to a large drum and as the ship sails south the drum unwinds, playing out the wire. The other end is connected to a telegraph set in New York, etc."

"My gracious me! How perfectly marvelous! What a wonderful idea! But it's a downright shame to fool the public that way and you should be ashamed of yourself, a nice clean looking young man like you. You naughty, naughty boy, lending yourself to such a scheme . . . but, Oh my gracious! Suppose the wire should break?"

"Then, madam," replied the crafty operator, "we would be without means of communicating with the shore." Then, as his excited fussy visitor took her departure, waddling like a duck from the room, he made a cautious gesture to her, placing his finger to his lips meaningfully. She acknowledged with a most important shake of her prodigiously bonneted head and was gone. A sigh of intense relief issued from the lying lips of the "naughty naughty" operator, as he reached for his trusty briar beside the antenna switch.

THAT evening the KVL ran into an unusually heavy storm off Cape Hatteras. The waves tore over her decks and swept everything before them and the ship pitched and rolled heavily. All the companion doors were locked and the passengers notified to

remain off the decks. Nearly all were suffering with the mal-de-mer and the stewardesses were doing overtime duty all night long.

Towards daylight as our "naughty naughty" operator ran off the last of the "Ocean Wireless News" on the ancient mimeograph, he was wondering how the "special" passenger fared in the blow. He laughed outright at his practical joke, little realizing how soon he was to learn a most valuable lesson as the aftermath of his prevarication.

Just as daylight revealed the angry seas heaving the sturdy ship all over the ocean, a most frightful series of screeches and screams came to his ears from the lower deck. They were repeated and soon a rushing of many feet below informed him that something was amiss and he had a desire to leave his post and investigate. However, he stuck where he belonged, as the captain's room was quite near. With the noise below increasing and the pandemonium swelling in volume he became more and more uneasy. Then, when several unusually heavy seas laid the KVL over on her beam ends he rushed from his shack into the smoking room and peered over the railing at a most shocking scene below in the lobby.

There in a big leather settee, attended by perhaps twenty terrified passengers of both sexes, sat the "special" passenger in extreme negligee, a look of wild terror on her chubby face. "Oh! I just know we shall sink and there is no way we can send out for help. Oh! this is just terrible. The wireless is down . . . gone, I tell you, officer. I saw it swept away with my own eyes. . . Oh! My God what shall I do. Why did I ever leave Henry to ride in this floating death trap! etc., etc."

The officer addressed rushed up the stairs and past our puzzled operator, making a hasty survey from the boat deck of the antenna, which was all in proper condition, curving graceful arcs in the cloud-strewn sky as KVL plowed her southward voyage. "What in hell ails that old dame?" he mused as he passed the "naughty naughty" operator.

By this time a most startling thought came to our "hero," and he dashed aft and peered over the top deck railing at the milky foam in the wake of the proud liner. His worst suspicions were confirmed—the tariff rail log was gone, apparently swept away by the mountainous waves.

(Continued on page 69)

Analysis of R.F. Transformer Performance

By Kendall Clough

Consulting Engineer, Aero Products, Inc.

THE market of the past two years has been literally deluged with so-called "low loss" coils. In spite of such statements as "lossless," "losses cannot be measured," etc., used in this connection, we know that the hypothetical coil possessing inductance and no resistance is a mathematical fiction. The measurement of the losses or high frequency resistance of such coils is a rich laboratory experience and the technical journals have presented a wealth of mathematical analyses pointing out the effect of coil resistance in the radio frequency transformer as a real and vital factor.

It is not the purpose of this discussion to derive anew the expressions for radio transformer, but rather to interpret by means of illustrative curves the meaning of some now accepted equations.

In the analysis of the transformer, we shall have frequent reference to the circuit shown in Fig. 1a, a stage of radio

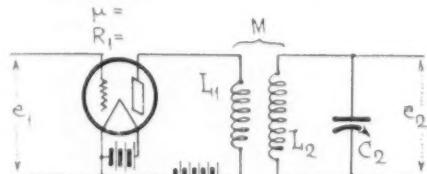


Fig. 1a. Circuit Diagram of Typical R.F. Amplifier Stage.

Fig. 1b. Circuit Equivalent of Fig. 1a.

frequency amplification. A radio frequency signal of voltage e_1 is impressed on the grid circuit of a tube having an amplification factor of μ and a plate resistance of R_1 . The plate circuit of this tube contains the plate battery and the primary of the radio transformer L_1 , which is coupled to the secondary circuit with a mutual inductance of value M . The inductance of the transformer secondary is given by L_2 and is tuned by the condenser C_2 . We are ultimately interested in the voltage gain as given by the ratio of the output voltage e_2 to the input voltage e_1 .

In dealing with such a circuit, it is more convenient to think of it in terms of the circuit in Fig 1b, where the tube and plate battery have been replaced by the hypothetical a.c. generator producing a voltage μe_1 with the plate resis-

tance and transformer in series. It should be noted that this generator in itself, has neither resistance nor reactance. The secondary coil, which has resistance as well as inductance, has been replaced by the lossless coil of mathematics and a resistance R_2 has been added in series to represent the losses that are actually measured in the laboratory.

The amplification given by this circuit, after the secondary has been tuned to resonance with the signal voltage, is given by

$$A = \mu \frac{\omega^2 M L_2}{R_1 R_2 + \omega^2 M^2} \quad (1) \quad \text{where } \omega \text{ is}$$

equal to $2\pi f$ and other factors are as given above. All of these quantities may be obtained by measurement. For ex-

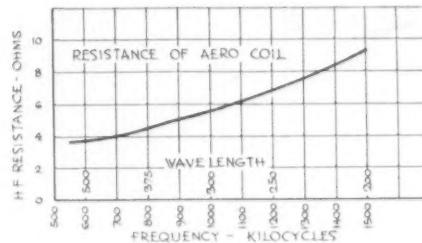


Fig. 2. Variation of High Frequency Resistance with Frequency.

ample, the curve of Fig. 2 shows the high frequency resistance of a typical coil at various frequencies of the broadcast band. The curve in itself, is of no physical significance, as its comparative value is limited to other coils of the same inductance. Naturally, a coil of higher inductance would have a higher resistance for the same effectiveness, and vice versa. In order that two coils of different inductances may be compared, two merit figures have been established in the art, both of which have a definite physical interpretation with regard to the performance of the coil.

The first of these figures is the ex-

pression $\omega L_2 / R_2$. This term has been plotted in Fig. 3 for the same coil, and as will be seen varies over the wave band. The significance of this figure may be seen by reference to Fig. 4

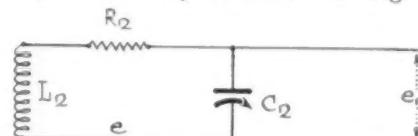


Fig. 4. Secondary Circuit of R.F. Amplifier.

where a small signal voltage has been impressed in series with the secondary circuit, and after tuning to resonance a voltage e_2 is produced across the tuning condenser or across the grid circuit of the tube following. This figure of merit, is equal to the ratio of e_2/e_1 and is directly proportional to the amplifying action of the secondary circuit. The voltage e is the voltage supposedly induced by the primary circuit. Obviously, a coil having a high value of $\omega L_2 / R_2$ will produce a high amplification with a given primary coupling. A further interpretation of this term, is in regard to the selectivity of tuning although the relationship is not direct. A different value for R_2 to be discussed later will be used.

The second figure of merit that has been advocated grows out of the equation for the amplification per stage that was previously given. From this equation may be derived another equation giving the greatest or optimum amplification that may be obtained from a given coil and tube. This equation may be written as

$$A_{\text{opt}} = \mu \frac{\omega L_2}{2\sqrt{R_1 R_2}} \quad (2) \quad \text{and by splitting up the equation into the form}$$

$$A_{\text{opt}} = \frac{1}{2} \frac{\mu}{\sqrt{R_1}} \frac{\omega L_2}{\sqrt{R_2}} \quad (3) \quad \text{it is seen that we}$$

have a figure of merit $\frac{\mu}{\sqrt{R_1}}$ for the tube as well as the figure of merit that we are discussing. This merit figure is also plotted in the curve of Fig. 2. Once a tube has been selected and its merit

figure $\frac{\mu}{\sqrt{R_1}}$ determined we may multiply the curve values shown by the figure of merit of the tube and obtain a curve for the maximum amplification of the coil, if the coupling between primary and secondary were adjusted to its best value at each point of the broadcast band. Incidentally, this curve points out the fact that uniform amplification cannot be secured over the

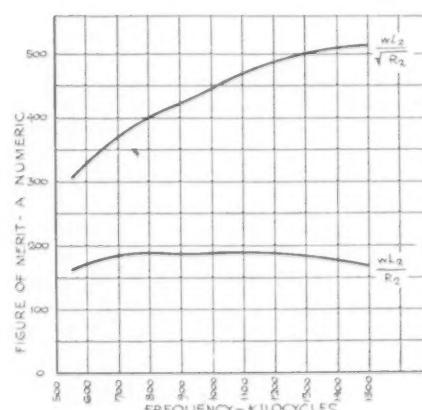


Fig. 3. Curves of Coil Merit.

entire band by means of a primary mechanically coupled to the shaft of the tuning condenser without severe sacrifice in amplification at the higher frequencies where it is most needed due to the low power of the average station in that part of the band.

It may be seen from the equation (1) that after the coil inductance and resistance and the tube characteristics of the stage have been determined, the only variable to be considered is the coupling or mutual inductance between the primary and the secondary. Let us investigate the effect of varying this factor with a coil and a tube of the 201-A type having an amplification factor of 8.0 and a plate resistance of 12,000 ohms. At a frequency about the center of the broadcast band (1000 kc. or 300 meters) we will plot a curve showing how the amplification varies with the coupling. The equation (1) is put in more convenient form for calculation by changing it to the type

$$A = \frac{\mu M L_2}{R_1 R_2 + M^2} \quad (4)$$

by factoring.

From the resistance curve of Fig. 2, we find that the coil has a high frequency resistance of 5.6 ohms at 1000 kc. The inductance of the coil is 168 microhenries, giving us sufficient data to plot the full line curve shown in

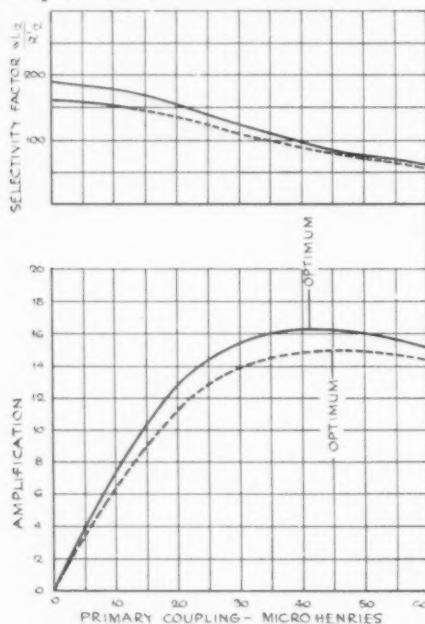


Fig. 5. Effect of Variation in Coupling on Amplification and Selectivity Factor.

lower Fig. 5. It will be noticed that the amplification rises very rapidly as the coupling is first increased and then reaches a maximum with a coupling of 41.2 microhenries. This value of optimum coupling is given by the equation

$$M = \frac{\sqrt{R_1 R_2}}{\omega} \quad (5)$$

while the value of amplification at optimum coupling is given by equation (2) and by substitution in the equation

or from the curve, we see that this maximum of amplification is 16.3.

On first thought, it might seem that this value of coupling would be the logical one to use, but we must first see what has happened to the selectivity of the stage. Referring again to the circuit of Fig. 1b, we see that for currents flowing in the secondary circuit, the primary with the plate resistance and the impedanceless generator across it have a shorted turn effect on the secondary. This effect has two results in the secondary circuit. The first is to reduce the effective inductance of the secondary and the second is to increase the apparent resistance of the winding. The first of these effects is negligible for the purposes of this discussion and we will regard the second only.

The increase in the apparent resis-

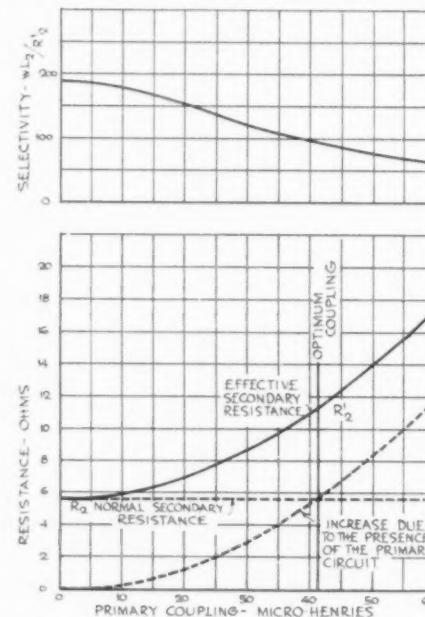


Fig. 6. Effect of Variation in Coupling on Secondary Resistance and Selectivity.

tance of the secondary is given by the equation

$$r = \frac{\omega^2 M^2}{R_1} \quad (6)$$

The value of this added resistance for the case that we have been discussing has been calculated and is plotted as the curved dotted line in the curve of Fig. 6. It will be noted that this curve crosses the horizontal line representing the normal secondary resistance at a value of coupling of 41.2 which was the value of coupling that we previously found produced the best amplification. In other words, we find that at optimum coupling, the apparent resistance of the secondary has been doubled as shown in the curve for the effective resistance of the secondary R'_2 . If the resistance is doubled, the selectivity has been halved as shown in the curve, the upper part of Fig. 6. It is apparent that any coupling decreases the selectivity from the natural selectivity of the coil alone. Such a decrease in selectivity as is indicated at optimum primary, is intolerable and commercial coils are never operated at that adjustment. In order that the reader may be able to interpret the factor $\omega L_2 / R'_2$ in terms of selectivity, the resonance curves corresponding to couplings of 0 and 41.2 microhenries (optimum for this case) are shown in Fig. 7. In the first case, the term "Per Cent of Maximum Amplification" is ambiguous as no amplification is produced by the secondary in the absence of a primary.

We will now see what the effect of the secondary resistance is on the selectivity and amplification of the stage. Suppose that a coupling of 21 microhenries gives the proper amplification and by reference to Fig. 5 is 13.1 and the upper curve shows that the selectivity factor is 150 at this coupling.

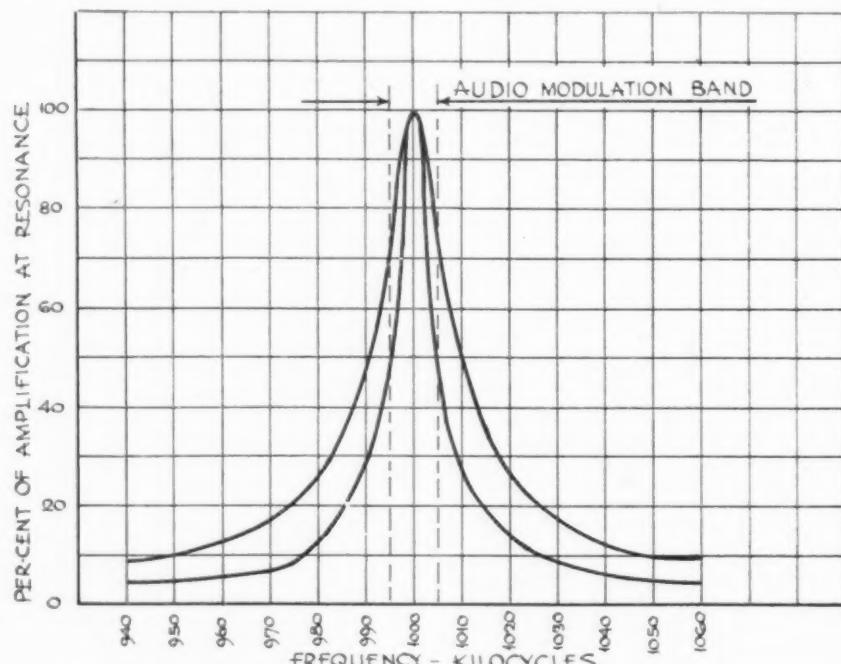


Fig. 7. Resonance Curves Corresponding to Couplings of 0 and 41.2 Microhenries.

Suppose now that the resistance of the coil is increased 1.0 ohm, making the total resistance of the secondary 6.6 ohms rather than 5.6 ohms as before. By use of the same equations as before, we compute the amplification and selectivity curves for this secondary as shown in the dotted curves of Fig. 5. We see from these curves that if we are to obtain the same amplification (13.1) that we obtained from the original coil we will have a selectivity factor of 120 which is much lower than before. On the other hand, selectivity may be at a greater premium in the design of the receiver than is amplification, so we will choose a coupling of 12 microhenries yielding the same selectivity factor as the better coil at 21 microhenries coupling (150). We find now that the amplification has fallen off to 7.4 which is lower than the value of 13.1 shown for the other coil. Thus we have seen in a practical way a fact that is demonstrated mathematically, that no compromise is possible in the way of coupling values that will compensate for the amplification or selectivity lost by an increase in coil resistance.

We have seen the effect of 1 ohm of resistance fictitiously introduced into secondary of the coil. This ohm might be introduced practically in a number of ways. It might have been introduced in the design of the coil by violation of any of the accepted standards, for example, by using a solid bakelite tube for winding rather than a skeleton frame or by the use of "dope" or cement on the windings, or by the use of a wire of the wrong size for that shape of coil. All these factors are beyond the control of the consumer and we will consider some of the things that might happen in installing the coils in a receiver.

Modern construction has brought the compact receiver and a considerable tendency is shown by many designers to crowd the equipment into small space. In doing this, the greatest care must be exercised that metallic bodies, such as condensers and audio transformers, are not put in the field of the coil. This field is greatest at the ends of the coil, so that this danger is the greatest when the mounting features of the coil necessitate its being mounted in a horizontal position, as is the custom when it is attempted to mount two or three coils mutually perpendicular. By making the coil sufficiently long in proportion to its diameter, it has been found possible to constrain the magnetic field, permitting the coils to be mounted in the same plane without danger of bothersome coupling taking place between them. This also allows them to be mounted with axes vertical so that the hazard of other bodies falling in the intense field at the end of the coil is reduced to a minimum. A curve is shown in Fig. 8 illustrating the coupling between two of

these coils when they are placed in the same plane and the distance between them varied. This curve points that if a separation of 5 in. is maintained (not a difficult separation in a compact set) the coupling between them will be 1.1 microhenries, a value that is negligible in practice.

Shielding always introduces certain losses in the coil, due to linking a portion of the coil's field, and also complicates the mechanical construction of the receiver. It will be seen from the curve that the necessity of shielding is mitigated as far as inter-stage coupling effects go, while the diameter of the coil is so small that direct pickup from local stations is reduced to a minimum as has been demonstrated in practice.

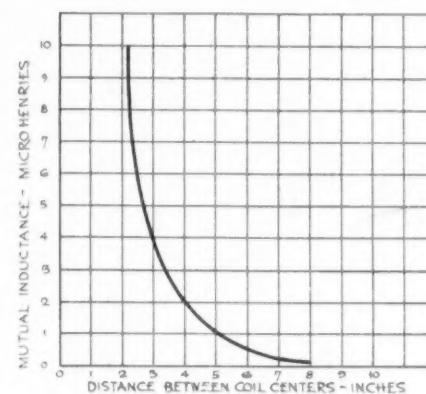


Fig. 8. Curve Showing Coupling Between Two Coil Secondaries Having Parallel Axes.

Radio broadcast reception long ago saw the day when one tube would serve all the purposes of the art. As a consequence, we now have four tubes that offer great possibilities as radio frequency amplifiers, the 201-A, 199, 112, and 240 types. In addition, there has arisen a wealth of circuits of both the regenerative and neutralized types. At least one manufacturer has recognized

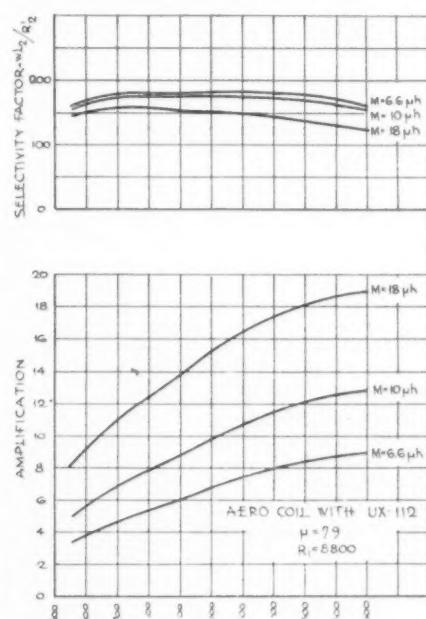


Fig. 9. Amplification and Selectivity Curves of Coil With 201-A Tubes.

these facts and is presenting a coil with a primary tapped in such a way as to be applicable to the majority of the tubes and circuits in use today.

The coil used in these measurements is provided with a bakelite base bearing six terminals numbered 1 to 6. In all cases 5-6 is the secondary of the coil, 6 being the grid terminal and 5 the filament connection. The primary is divided into three sections. The mutual inductance of each of these sections to the secondary is given as follows:

Primary	Coupling Microhenries
1-2	10.0
1-3	18.0
1-4	35.5
2-3	6.6

No matter what combination is used for primary, the lowest number is always the plate connection and the higher terminal number the plate battery connection.

In order to illustrate the uses of such a coupling device, several curves are shown illustrating the performance of different commercial tubes with different couplings.

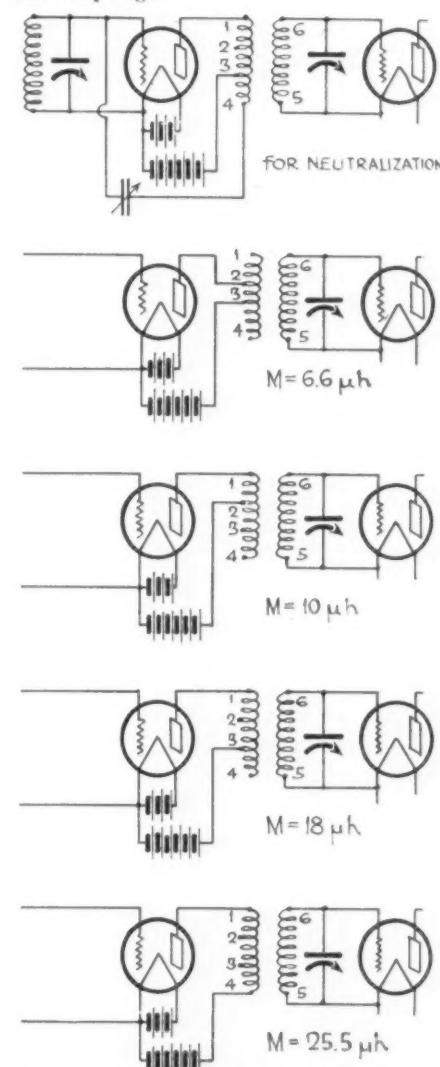
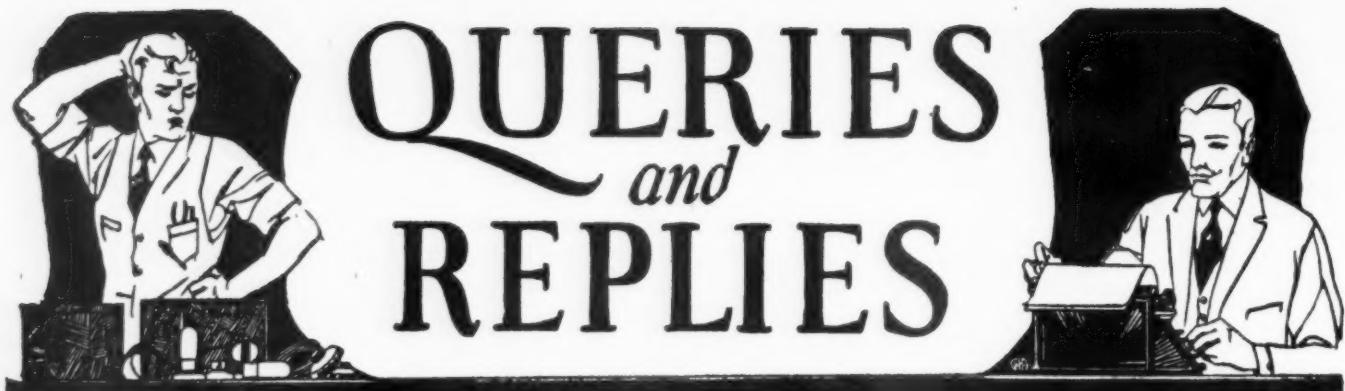


Fig. 10. Connections for Producing Various Couplings in Neutralized Circuit.

In Fig. 9, are shown amplification and selectivity curves resulting from the use
(Continued on page 70)



Questions of general interest are published in this department. Questions should be brief, typewritten, or in ink, written on one side of the paper, and should state whether the answer is to be published or personally acknowledged. Where personal answer is desired, a fee of 25c per question, including diagrams, should be sent. If questions require special work, or diagrams, particularly those of factory-built receivers, an extra charge will be made, and correspondents will be notified of the amount of this charge before answer is made.

Please publish a good circuit for my Thorola doughnut coils, with a total of five tubes to be used.—L. F. C., Oakland, Calif.

A good five tube circuit using a three gang .00035 mfd. condenser is shown in Fig. 1.

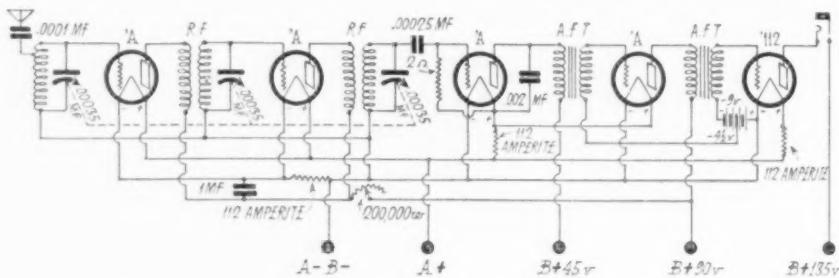


Fig. 1. Circuit Diagram for Five Tube Doughnut Coil Receiver.

In July 1927 RADIO is shown a short wave converter. Can this be used in connection with my Victoreen Super? In such a set, is the converter plugged in the first or second detector?—J. T. G., East Cleveland, O.

You can use the converter with your set without difficulty. It plugs in the second detector socket, and the intermediate amplifier, oscillator and first detector tubes are not used. If the converter is to be used often, a switch located on the panel of the superheterodyne, to cut out the filaments of the above mentioned tubes would be very handy.

I will soon have to take a government examination for a broadcast station operator's license, and am told that I will have to draw the circuit of a typical broadcasting station. Could you furnish me with such a diagram, giving such constants about the apparatus as you think might be required?—C. S. B., Los Angeles, Calif.

The schematic circuit diagram of the

Western Electric 1-B transmitter is shown in Fig. 2. It has been somewhat simplified to omit complicated switching connections and other details which I do not believe would be required by the examiner. The speech amplifier shows only the theoretical circuit, omitting many

headphones are generally used for listening in, the power tube will not be needed, and a seven tube set can be constructed for special interference work, thereby lightening the set by a considerable amount. To get the true bearing of a source of r.f. transmission, such as a leaky insulator or other defective apparatus, it would be necessary to have direction finding equipment similar to the radio compass used for marine radio work, but where the set is placed in a car and carried from place to place, so that observations can be made frequently, the ordinary loop type superheterodyne is satisfactory.

Have been unable to make my Best 45,000 cycle superheterodyne work on wavelengths above 400 meters. At first I could get up to 545, but the upper range has gradually fallen away until the highest wave stations I can now get are around 400 meters. What could be the trouble?—E. W. U., Elgin, Ill.

The trouble is undoubtedly in your oscillator circuit. Either there are short circuited turns in the oscillator coil, or the oscillator condenser plates are shorting together after they have become partly enmeshed. Examine the coil carefully, and test the condenser with a battery and headphones to determine the above points. The condition of the intermediate amplifier does not usually control the wavelength range of the set, for if the set now brings in stations below 400 meters satisfactorily, you can be sure that the a.f. transformers are O. K.

Please tell me how to build an interference locator for determining the sources of radio interference in city districts.—A. K. P., Gustine, Calif.

A good superheterodyne of the portable type is the most satisfactory kind of receiver to use for locating interference. Such a receiver was described by H. W. Armstrong in May RADIO. As

(Continued on page 72)

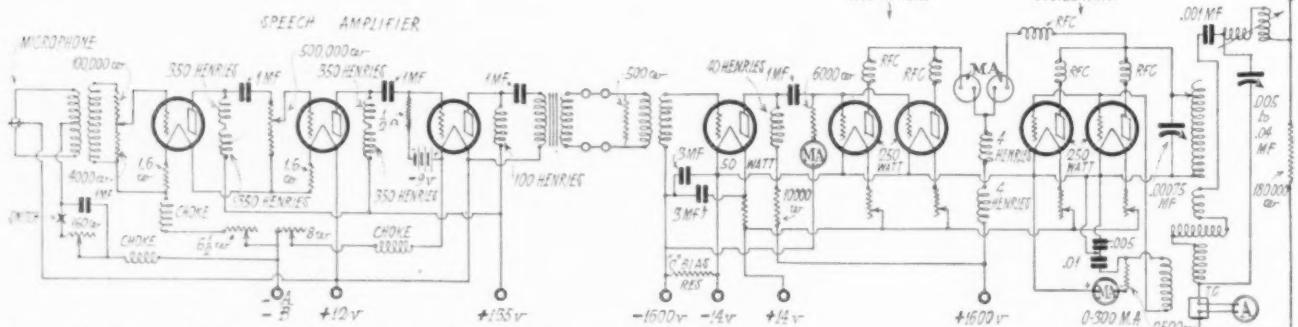


Fig. 2. Schematic Diagram of Typical 500 Watt Broadcasting Station.

AN IMPROVED CAPACITY MICROPHONE

By C. K. STEDMAN

An extremely simple capacity microphone which is free from distortion can be made by the amateur in accordance with a design originally proposed by Dr. D. F. Stedman. Its chief features are its gold-leaf diaphragm and laminated back electrode. Its general construction is shown in Fig. 1.

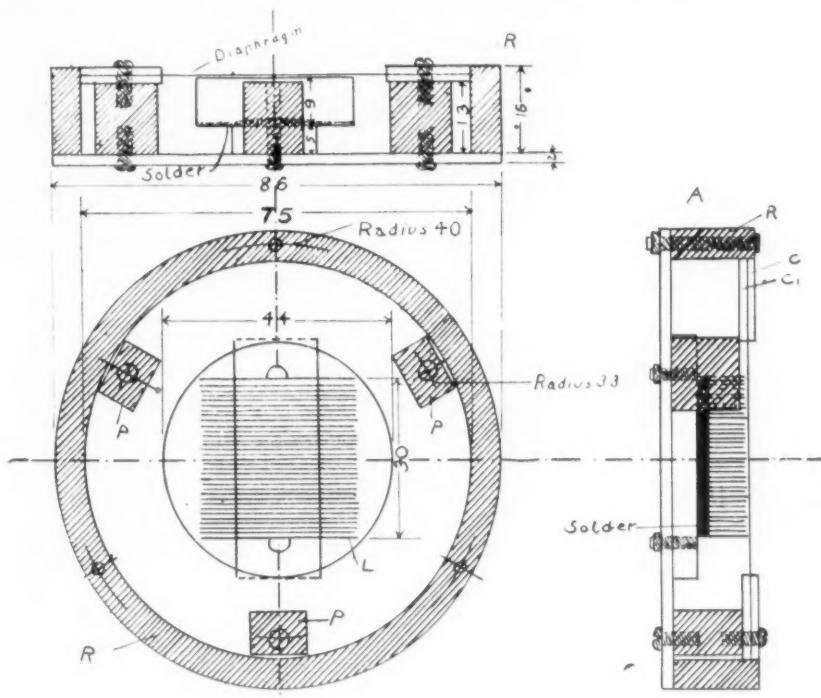


Fig. 1. Structural Details of Capacity Microphone.

The back plate *A* and the hard rubber ring *R* are the only parts which need machining, as the two clamping rings *c*, *c'*, are from some part of the innards of a Ford and can be bought ready cut. The insulating supports *P* are hard rubber, and as they must be exactly the same height, and are best made by planing parallel faces 13 mm. apart on a larger block, and then sawing the smaller pillars from it.

The making of the back electrode presents the greatest difficulty as the top must be not only flat, but parallel to the base. For the solid part, get a piece of smooth strip copper (a scrap switch-blade is fine) heavy enough not to bend in working, and cut a piece to size. If the faces are not very flat, they must be ground or filed down, taking care to keep the front and back parallel. Clean one side and tin it.

The laminations are best bought as 9 mm. by .13 mm. (0.005 in.) copper ribbon, and cut off to the right length. Don't try to cut wider ribbon down as it can't be done well enough. Next cut 40  shaped pieces of cardboard, each about 30 mm. by 8.5 mm. by .8 mm. and build them up into a little block, a piece of copper between adjacent strips of cardboard.

Tie the block around edgeways with thread, and with it laying flat down on some very level surface, carefully push each strip of metal and cardboard hard down. The block should now be absolutely flat on one side, and on the other, adjacent pairs of copper strips should form shallow troughs, with a depression in the middle where the *V* is cut from the cardboard.

Now flux that latter side and, taking care not to twist the block out of flat, fill it solid with solder. If this is done with the flat side resting on an upturned flat iron it is easier to

keep the block from twisting, and the extra heat helps the solder to flow into the cracks. The solid base can now be laid on top of the little block of laminations, and the two sweated together. When the electrode is cool the cardboard can be picked out with a pin.

In the absence of accurate calipers, the holes in *A*, *c*, *c'* and *R*, can best be laid out as follows: Describe circles with radius 33 and 40 mm. on *A*, and draw a radius at every 60

to apply. Mark on the blackened side a square, the size of a gold leaf, so that one side of the square is an edge of the plate.

Now remove one gold leaf from a book. This is best done by laying a spare sheet of ochre paper on the leaf to be removed, inverting the book, opening it again at the right place, and sliding the loose sheet out with the required gold leaf on it.

Draw a thin line of shellac along the four sides of the square on the aluminum plate, and placing the side which is along the edge of the plate, along an edge of the gold leaf, lower the plate onto the leaf. The gold leaf should now be stuck by its extreme edges to the blackened side of the aluminum. Now, put the aluminum, black side up, on the iron, and warm the iron until the pockers are pulled from the leaf. It is best not to use a high enough temperature to boil the shellac. When the leaf is nicely taut, move it to one side and lower the steel ring onto the iron.

When that is hot, lift it up, run a very thin line of shellac around its bottom face, and quickly lower it onto the center of the gold leaf. Once it is lowered, keep it pressed tight down, and put a heavy weight on it. Let the whole works cool down, and then after ripping the leaf in two or three places where it extends outside the ring, very slowly lift the ring and the leaf with it from the aluminum plate. If the plate was properly blackened the leaf will show no tendency to stick.

If difficulty is experienced in handling gold leaf, it may be well to practice with silver leaf. Its expansion coefficient is such that the same method of stretching can be used, and it is much thicker than the gold. Judicious blowing is the best method of handling gold leaf in almost any emergency.

Many variations of methods of mounting are possible, but the one described is the most nearly fool-proof. Fairly tight diaphragms may be mounted cold by gently blowing through the center of the ring while lowering it onto the leaf. A leaf so mounted can be tightened a little by sliding the ring onto an iron which is just hot enough to boil the shellac. The bubbles formed pull up the slack in the diaphragm.

To insure good contact between the rings and the gold leaf, it is well to place a washer of very soft lead foil between the leaf and the clamping ring.

For use, the microphone is kept in a draught-proof box about 6x6x2 in., whose two faces are very tightly stretched wire gauze, covered with cloth. This hardly affects the sensitivity but does prevent passing draughts from bellowing the diaphragm in and out. The microphone must be fastened firmly in the box, and not hung on springs. The box may be sprung if desired.

The microphone is used in a tune and detune absorption circuit. Any oscillator may be substituted providing it is smooth enough in operation. The chief point is the use of the two condensers in series to give a very fine vernier tuning.

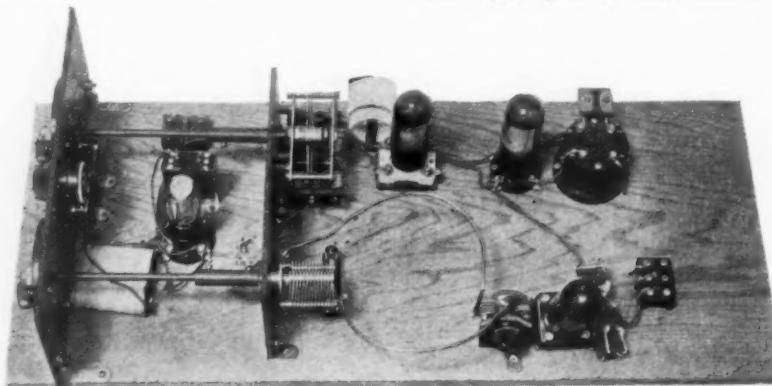
Fig. 2 shows four resonance curves corresponding to four values of coupling, *L*₁, *L*₂. To adjust the set to give the required curve, it is made to oscillate gently and the coils are placed fairly close together. The rough tune is then found by the clicks, and the coils separated until a curve corresponding to about *D* is given. They can now be adjusted closely to give the required curve. These curves need not be actually plotted, for the operating conditions show very clearly on the milliammeter. For maximum sensitivity with stable operation, the set is adjusted to a point around 1.45 m.a. on curve *B* *A* is only included to show the complete effect of increasing coupling. It represents just close enough coupling to stop

(Continued on page 78)

A 5-METER SUPER-REGENERATIVE RECEIVER

By FRANCIS CHURCHILL

Very little experimental work has been done on the shorter wavelengths, in particular the amateur's five meter band. The chances are that during the coming year a great deal of work will be done by the A. R. R. L. to develop this band. One of the essentials for this kind of work is a sensitive receiver which can be easily operated, such as the one in use at 6AJF.



5 Meter Super-Regenerative Receiver

With such a receiver, a study can be made of 5 meter transmission as regards distance, local use, directional antenna and many such problems. I believe that practically all of the transmission on wavelengths below 10 meters will be with directional antenna, such as a parabolic reflector or parallel grid reflector. Local tests have shown that even with a three wire reflector in the general shape of a parabola the power or energy in a given direction is increased a great many times. This is only one phase which can be investigated with a good 5 meter receiver.

The usual regenerative receiver is hard to tune on 5 meters, except for very strong signals. They are microphonic as well as insensitive. The usual regeneration control throws the tuning all over the scale or doesn't work at all or is extremely noisy.

The use of super-regeneration seems to cure all of these faults, microphonic tube noises are greatly reduced, the tuning is a joy for simplicity, and it is a great many times more sensitive. In this receiver the feed back control is quiet, and doesn't change the tuning at all.

The set uses four tubes, one as the super-

regenerative detector, one as a 17,000 cycle oscillator, one as a heterodyne, and the fourth as a feedback control. This last item is an interesting scheme of varying the plate current of the detector without getting the usual noise when using a variable resistance for feed-back control. The plate-filament impedance of this tube is varied over wide limits by the use of a variable bias on the grid. This is obtained by means of a 0-2000 ohm potentiometer as shown in Fig. 1.

The 17,000 cycle oscillator, used to obtain

a rapidly changing grid bias for the detector, is made up with an old intermediate frequency transformer out of a superheterodyne receiver. This transformer, iron cored type, is shunted with a large enough fixed condenser to cause the circuit to oscillate at about 17,000 cycles per second. This super-regenerative effect makes this circuit extremely sensitive and also tends to broaden the tuning quite a little. This latter effect is extremely beneficial on the 5 meter band as well as the former.

In order to receive cw signals it is necessary to heterodyne them to an audio frequency say a 1000 cycles per second. This is done by means of a separate heterodyne oscillator in the neighborhood of 100 meters and tuned with a 3 plate variable condenser. One of the harmonics of this oscillator is used to beat against the incoming signal.

The coils for this oscillator were made by winding 35 turns of No. 25 d.c.c. wire on a form 1 1/4 in. in diameter for the grid coil, and 15 turns of the same wire on 1 1/2 in. diameter for the plate coil. These coils were cemented in shape with collodion and the

cardboard tubing removed. The 3 plate variable condenser C_4 across these coils has a long extension fibre shaft in order to get away from hand capacity effects. Both this condenser and the main tuning condenser C_1 have vernier dials on fibre extension shafts.

The detector circuit is a form of the Colpitts circuit with the inductance in two halves which with the two condensers C_1 and C_2 make one complete turn. This inductance is made of soft 1/8 in. copper tubing and is fastened securely to the condensers which act as the supports. It is necessary to use either soft wire or soft tubing for this in order to get away from any natural tendency for vibration. This is a very important item in any 5 meter receiver. The condenser C_1 is a .000135 mfd. maximum variable condenser of the midget variety with a fibre extension shaft, as this is the main tuning condenser. It is in effect a series condenser, while C_2 is a shunt condenser, and as such can be varied over considerable value without changing the tuning a large amount.

C_2 , on the other hand, changes the wavelength very fast and so is used for setting in jumps. For instance with one setting, the series condenser C_1 will tune from 3 1/4 to 4 meters, C_2 is then increased a few degrees, and C_1 used to tune from 4 to 4 1/2 or 4 3/4 meters. In this way the receiver will cover from about 3 meters up to 10 meters with this inductance and yet the tuning is never "sharp." For coming back to the same wavelength, a wavemeter should be used in every case. A wavemeter calibrated carefully from "parallel wires" is an absolute necessity on all short wave work.

The detector tube socket should be mounted on a soft rubber cushion such as a rubber sponge and the leads to it made with small gauge wire in order to prevent vibrations being transmitted to this tube. For the same reason it is advantageous to use a detector tube which has the internal elements rigidly supported. The two radio frequency chokes in series with the detector filament leads are not absolutely necessary but do keep the r.f. energy out of undesired places.

The r.f. choke in series with the plate circuit of the detector should be preferably basket-weave of about 30 or 40 turns on a 1/8 in. diameter. The main idea is to use a choke with as low a distributed capacity as possible and the basket-weave works admirably for this purpose. The audio-frequency passes through this choke and is by-passed around the feed-back control tube by means of the 1. mid. condenser C_6 .

In operating the receiver a rushing or hissing sound should be heard in the receivers when the 17,000 cycle oscillator is working and the feed-back control is set up far enough. This rushing sound is slightly reduced when one of the harmonics of the heterodyne oscillator crosses the wave to which the receiver is tuned. When any kind of an outside or inside aerial is coupled to the inductance, all of the Fords within several blocks will be audible as well as other types of automobiles, motors and various electrical appliances. The aerial may be coupled to the detector by having it pass along within a few inches of one side of the inductance. Any kind of an aerial may be used for receiving, from 1 to 100 yards in length.

Five meter signals of 6CNC were barely audible on a straight regenerative receiver and a movement of a hundredth of a degree on the tuning dial lost him completely. With the super-regenerative set, the signals were of very strong intensity and the tuning condenser could be moved a half degree in either direction without losing him. There was absolutely no comparison between the two systems which was at all favorable to the usual regenerative system.

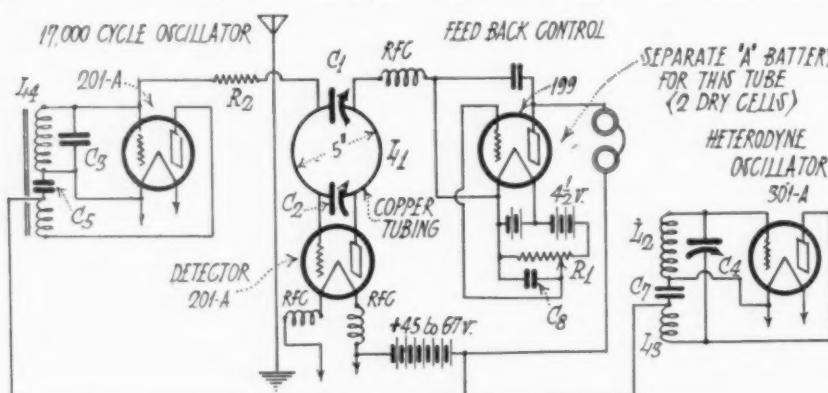


Fig. 1. Circuit Diagram for 5 Meter Super-Regenerative Receiver.

C_1 —.000135 mfd. variable Precision midget condenser
 C_2 —.000040 mfd. variable midget condenser
 C_3 —.00025 mfd. fixed condenser
 C_4 —.001 mfd. fixed condenser
 C_5 —3 plate Cardwell condenser
 C_6 —1. mfd. Electrad by-pass condenser
 C_7 —1. mfd. Electrad by-pass condenser

R_1 —0-2000 ohm Electrad potentiometer
 R_2 —100,000 ohm Electrad leak
 L_1 —Inductance—1/8 in. copper tubing, one turn 5 in. diameter supported by C_1 and C_2
 L_2 —35 turns No. 24 wire, 1 1/4 in. diameter
 L_3 —15 turns No. 24 wire, 1 1/2 in. diameter
 L_4 —Intermediate frequency iron cored transformer

ARGENTINA FC-6

The station shown in the picture is that of Argentina FC-6, owned by Dr. Julio Hiver, at Santa Fe, Argentina. The transmitter consists of three UX-210s in a Hartley circuit, with 500 volts of storage battery d.c. on the plates. The transmitting inductances are pancake wound, with heavy copper tubing, and the oscillator is designed to work on 20 as well as 33 meters, in connection with antenna systems for both wave bands.



Station sa-FC-6 Santa Fe, Argentina

Dr. Hiver's records show stations worked in practically every country in the world, which is not surprising, judging by the way his signals pound in at nu 6-XAO.

CALIBRATION OF A 5-METER WAVEMETER

By A. BINNEWEG JR.

As a frequency meter is essential to any experiments with 5-meter transmission, a simple means of calibrating the meter is important. Such calibration may easily be accomplished with the high frequency oscillator illustrated herewith. It consists essentially of two midget condensers in the plate and grid leads of a UX-210 vacuum tube, a 5000 ohm grid leak, plate and grid chokes, and batteries for filament and plate supply. The oscillator circuit is shown in Fig. 1.

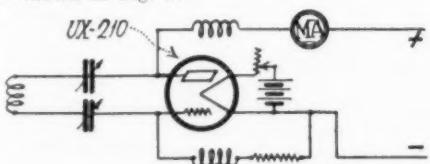
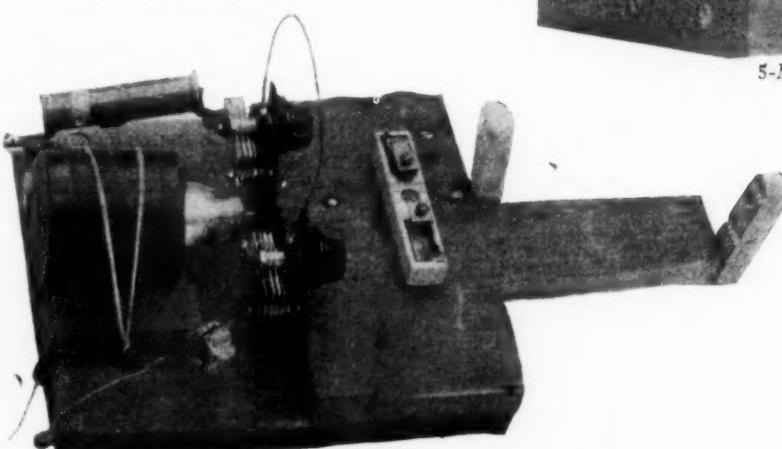


Fig. 1. Oscillator Circuit.



High Frequency Oscillator for Calibrating Wavemeter.

RADIO FOR OCTOBER, 1927

45

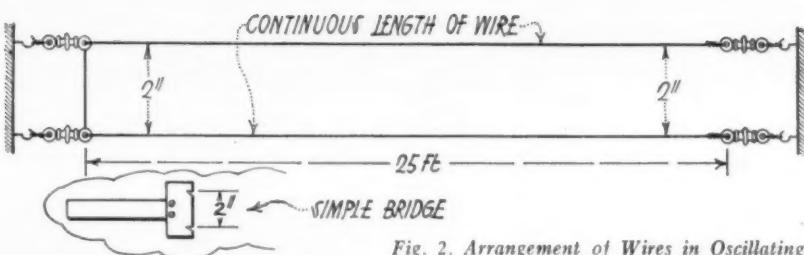
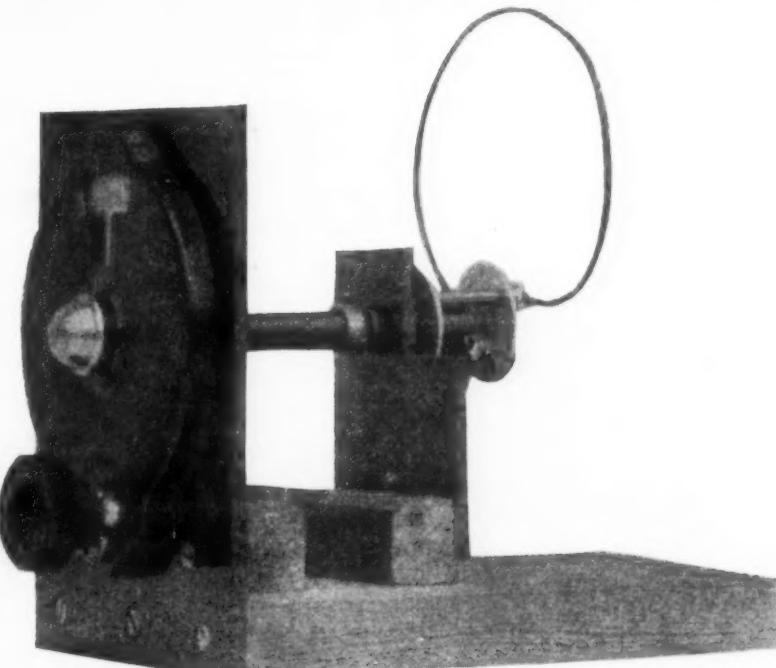


Fig. 2. Arrangement of Wires in Oscillating Circuit, 5-Meter Wavemeter.

The oscillator shown in the picture was made by mounting two 45 picofarad Chelten midget condensers on scrap bakelite fastened to the edge of the upper of two overlapping box ends which are screwed together. A telephone fuse holder and a pair of porcelain cleats to guide the wires which constitute the oscillating circuit are also mounted on this board. The vacuum tube is laid on its side, tied in place with twine, and its pins soldered directly to the leads from the condensers. The chokes are 20 turns of small wire in a Lorenz winding. From 90 to 112½ volts suffice for the plate.

The oscillating circuit consists of a pair of horizontal wires spaced 2 in. apart and 25 ft. in length. Fig. 2 shows a convenient arrangement. One end of each wire may be fastened to the wall and the other end passed through the cleats and fastened to the fuse holder upon which the coupling loop is mounted.

The wavemeter consists of a Chelten midget condenser cut down to a maximum capacity of 30 picofarads, a vernier dial and scale with extension shaft, and a coupling loop, mounted



5-Meter Wavemeter.

as shown in the picture. The circuit is shown in Fig. 3. The baseboard is a piece of $\frac{3}{8}$ in. board, 4 by 7 in. The panel is of $\frac{3}{16}$ in.

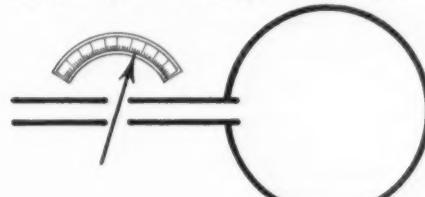


Fig. 3. Circuit Diagram of Wavemeter.

bakelite, $4\frac{1}{2}$ by 6 in. The condenser is mounted on a 2 by 4 in. piece of bakelite. (Continued on page 74)



The COMMERCIAL BRASSPOUNDER

A Department for the Operator at Sea and Ashore



R. O. KOCH, Great Lakes Correspondent

Edited by P. S. LUCAS



C. WILLIAM RADOS, Boston Correspondent

LETTER TO THE EDITOR

Sir:—Have been a constant reader of your department for some time and to date have not caused any QRM, but if the old mill doesn't catch on fire within the next few minutes—well, QRX.

Was struck by two contributions to your department in the issue of February. They were so incongruous had to laugh: a lengthy dissertation on progress made in marine installations on American ships and alongside of that—wonder of wonders!—a "plea" for help in TR work! American companies have surely moved forward, but the operators are either standing still or there are a few throwbacks among the ensemble.

Back in the days of the *Republic* and the *Titanic* a TR was undoubtedly a useful thing, but in these days of schedule runs and excellent transmitters I fail to understand why an otherwise intelligent operator should howl for half a night gathering unto himself a flock of TRs. And, incidentally, getting called any number of names in a hundred radio cabins where a few honest-to-goodness brass-pounders are trying with all their might to move commercial traffic through a blanket of heavy static and the persistent clamor of the saphire yelping for position reports. I have

noticed that these birds invariably use the regulation calling wave for transmission and usually send each word twice, interspersing the TR with innumerable DIT DIT DIT DAH DITS and interrogations. Then, having finally sent the TR, the man who has been waiting for him to get finished calls a station with a msg. But lo, here is our friend again, still on 600 meters sending SVC stuff to a string of ships, and I have yet to see the man who could hear a station answer him through the QRM a TR hound raises when he is really in trim. And it is all on 600 meters, which is, according to regulations, strictly a calling wave. But our hero cares nothing, evidently, for regulations or the good-wishes of operators on ships around him. He blithely goes through his list giving each fellow he works a merry word of cheer, etc., cluttering up the ether with useless signals that are nerve-racking to say the least.

Instead of getting up at 2 A. M. for a schedule, I believe that if these fellows got up at 12:30 A. M. and spent the time reading Regulations of Radio Communication and getting code practice with a buzzer, we would hear more readable calls and less QRM on 600 meters.

I had the pleasure (?) of running about 30 miles astern of one of this type operators

once from CTG along the coast to WNU. He gave his TR to every coast station along the coast and every ship he could raise, and to fill in, he would call WSC or KOK at intervals, not, seemingly, with any hope of raising them, but just for practice. I have an idea that no one copied him, for he was almost unreadable.

I am heartily in favor of eliminating all this QRM on 600, for besides being an infraction of the regulations it delays commercial traffic inestimably, because it is almost impossible to raise a station through QRM and a continuous stream of CQs when these boys get really wound up and feel good.

For the fellow who says he is "KSO" (whatever that is) KOK until 2000 miles away, I offer a suggestion that he look up his schedule and then mail a herd of TRs before sailing, with appropriate dates and positions marked in boldface type. QSU.

DON E. SELF,
SS. Heredia.

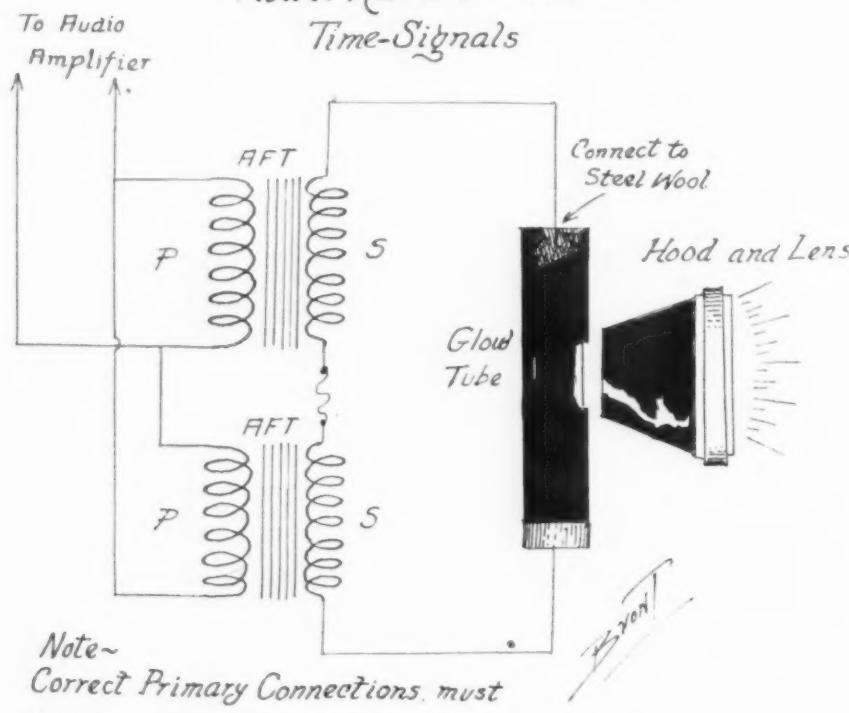
P. S.—Here's a new Q signal: QLF, meaning: Use other foot, can't read you.

Well, we haven't mentioned unnecessary QRM for a long time, so I guess it is safe for us to bring the subject up again. Whether it is safe or not it seems to be our religious duty to harp on it occasionally in order that this poor overworked ether might be just a little clearer for the important commercial traffic.

Although it may appear to some that Mr. Self, author of the above, waxes unnecessarily sarcastic, those of us who have ever made the Gulf run, or practically any other coastwise run, can easily agree with everything he has said. For a good many years interference has been almost unbearable, and instead of getting better it seems to be getting worse. The reason? Just as Don Self pointed out: While equipment is moving forward, operators are standing still. We are holding our own. We, the general run of us, are just as good operators today as those fellows who operated the straight gaps of the old days. Some are better; some are worse; but the average is probably about the same.

But when we get to talking about operating ability we had better stop and decide what the term really means. Lots of things enter into it, of course, such as speedy code copying and clean-cut sending, knowledge of the apparatus, willingness to work, accuracy and attention to details. But willingness to work isn't operating ability, in itself. Neither is code speed nor engineering genius. In our humble opinion, operating ability involves every one of these aforementioned talents plus a goodly supply of common-sense, intelligence, thoughtfulness and unselfishness. To be a good operator a man must have the good of the profession at heart; he must know what traffic is important traffic and be willing to eliminate all that isn't important; he must be faithful to his company, ready to help his

Visible Radio Beacon- and Time-Signals



A Self-Explanatory Diagram.

fellow operator when needed, but ready also, and willing to maintain a continuous QRX when he has nothing IMPORTANT on the hook.

It's asking a lot, we'll agree, to request such complete silence. For some fellows it means that not a wave train will leave their antenna from the time they clear KPE until they get to the Canal; an inactivity that sometimes seems unbearable, for the desire to fill the air with high-frequency oscillations is second nature to the radio operator, and usually a TR is the only logical excuse available. But really, fellows, TRs aren't important. If the steamship company demands it there seems to be nothing to do but shoot. If the steamship company does not demand it, it seems that your duty as an operator is to eliminate the TR as unnecessary traffic.

What say? Are we going on holding our own with the straight gap men or are we going to take our place with the companies in their march towards perfection? Let's show ourselves and everyone else that we have the kind of operating ability that will make the radio profession as efficient a business as banking. Think twice before you push that switch.

"HAMANTICS"

While enroute from Balboa to San Pedro last trip we happened to be traveling with a British vessel, on a cruise around the world. About five days out from Pedro this fellow eq's for a qr to San Pedro. Finally a fellow pipes up and says he can qr to a certain company via another ship. He receives and gets off this traffic ok, and some more during the day. So far so good.

The next day he meets a ship serviced by his company, and after "chewing the fat" for quite a spell the conversation ends up something like this, "Say Om we have the S.S.—(call) G—, of the —Line, on a cruise around the world, out here. He is not qso Pedro, and we want to get all his traffic for the —(name of service company)—. He will be sending in quite a bit of stuff so keep a sharp lookout for him and don't let anything get away from us." And the British operator was probably listening to this hogtieing scheme. Well the other fellow said, "R ge," and terminated the conversation. He seemed sort of peed, and ashamed of this "aspiring youth," and that was the last of him in the matter.

The ambitious "A.Y." kept a very sharp watch though because the British vessel couldn't even call another ship without this young hopeful piping up and asking if he had a msg.

The fellows on the British vessel must have gotten pretty well fed up on this because as soon as they could they diverted their traffic to the other Pedro outfit, even though the "A.Y." broadcast the fact to them repeatedly that he would qr "free" to Pedro.

I heard them receive traffic from the first station, ok it, then call the other station and give him a couple they had on file when the other was received, regardless as to whether they were answers to msgs received from the first station or not.

The theory of patronizing their own company can't be applied here either because they are known to be partial to the first outfit. The only reason I can see is that they were sick of this American's "Hamantics" and the fact that his company tolerated such, for as I am told an Englishman has pride in being an operator, and although some of them are excellent hams they are never proud of it, which seems to be the case with fifty per cent of the American operators.

A good motto is, "Help the other fellow out but don't make a pest of yourself." He will call you when he wants you. Let's hope the commercial hams will adopt this in time. It feels good to have something to hope for at least.

NORTH PACIFIC SCHEDULES

By L. O. "Mickey" Doran

This constitutes the first of a complete new set of *Marine Radio Notes for North Pacific and Oriental waters*. The data should prove invaluable to operators in these waters as they represent the most complete and accurate information possible to compile. The complete set will subsequently be printed in book form.

TIME	GMT	CALL	WAVE	REMARKS	1200	GBR	18740	Press. CW.																
0000		GBR	18740	Press. CW.	1200	NPM	11490	Time sigs. CW.																
0000		XRT	600	‡Weather. Spk.	1200	VPS**	600	‡Weather. Spk.																
0000		JMAA	800	‡Weather. CW.	1230	JTJ	750	‡Weather. Spk.																
0010		JFRA	4000	‡Weather. CW. (2)	1255	BXY	2200	Time sigs. CW.																
0030		JTJ	600	‡Weather. Spk. (3)	1300	NPC	2541	Weather. CW.																
0030		XRT	2800	‡Weather to XPI. Spk.	1400	FFZ	1300	‡Weather. CW.																
0100		NPC	2541	Weather. CW.	1600	WWBO**	750	Weather. Spk.																
0130		NPE	2677	Weather. CW.	1600	NPE	600	Weather. Spk.																
0130		NPI	2939	Weather. CW.	1700	NPL	18740	Press. CW.																
0155		BXY	2200	Time sigs. CW.	1700	NPC	7005	‡Weather. CW.																
0200		JRW	10000	Weather. CW.	1700	NPL	2800	Time sigs. CW.																
0200		JJC	7700	Time sigs. and ‡ Weather. CW.	1730	NPE	2541	Weather. CW.																
0200		JCS**	600	**Time sigs. and ‡Weather. Spk.	1955	NPG	2939	Weather. CW.																
0200		NPO	5260	Press to Navy. CW.	2000	GBR	2677	Weather. CW.																
0253		FFZ	750	Time sigs. and Weather. Spk.	2000	WWBO**	600	Weather. Spk. (4)																
0255		NPO	5260 and 2677	Time sigs. CW.	2100	NPC	2541	Weather. CW.																
0255		VAE	600	Time sigs. Spk.	2130	NPE	2677	Weather. CW.																
0300		HVM	600	‡Weather. Spk.	2230	NPM	5552	Weather. CW.																
0300		HVI	600	‡Weather. Spk.	2355	NPM	11490	Time sigs. CW.																
0330		NPG	7005	‡Weather. CW.				CW designates arc or tube.																
0400		VPS**	600	‡Weather. CW. (Call may be changed).				**Ships are especially cautioned not to interfere with the schedules marked with the double star**.																
0400		WWBO**	600	Weather. Spk. (4)				‡—Indicates that the weather is sent only in code.																
0400		NPC	2541	Weather. CW.				‡—Indicates that the code weather report is followed by a plain-language report. All of the weather codes used by the various stations are given on the following sheets.																
0405		KPH	675	Weather. CW. (5)				Numbers in parentheses refer to the following:																
0430		WNU	3331	Weather, traffic and press. CW. Good.				(2)—JFRA Tokyo. After the finish of the 4000 meter transmission, JFRA repeats the plain-language portion of the report on 600 meters CW. This is the best Japanese weather report.																
0430		NPE	2677	Weather. CW.				(3)—JTJ Kobe, repeats the report on 2650 meters CW immediately after finishing on Spk. Poor arc on 2650.																
0500		VPS	2800	‡Weather. CW.				(4)—All Pacific Coast Light Vessels send weather at the same time. WWBO, WWBP, WWBQ, WWBU and WWBV.																
0515		WRQ	13500	Press. CW.				(5)—KPH repeats the plain-language portion of NPG's Major Weather Bulletin and also repeats WWBV weather, first on 675 and then on 2200 meters CW.																
0555		NPG	4836 and 2776	Time sigs. CW.				(6)—XPI Pratas Island, repeats the report on 1450 meters CW, after finishing the 650 meter transmission.																
0600		VAE**	600	Weather. Spk. (8)				(7)—Much of NPM's day traffic goes through on about 20 meters instead of 11490 meters as shown.																
0600		2UO	40.8	Press. CW. (N. Y. Times) Good.				(8)—VAE repeats the report on 1700 meters CW. after the finish of the spark transmission.																
0600		XPI	650	Weather. Spk. (6)				Unless otherwise mentioned, the times given are in G.C.T. (Greenwich Civil Time). This can be converted to P.S.T., Pacific Standard Time, (time of 120th Meridian West) or to C.C.T., China Coast Time, (time of 120th Meridian East) by means of the tables below:																
0600		JFRA	4000	‡Weather. CW. (2)	CCT	8	9	10	11	12	13	14	15	16	17	18	19	20						
0630		JTJ	600	‡Weather. Spk. (3)	GCT	0	1	2	3	4	5	6	7	8	9	10	11	12						
0700		NSS	17130	Press to Navy. CW. NAA simultaneous on 37.4 mtrs. Good.	PST	16	17	18	19	20	21	22	23	0	1	2	3	4						
0800		NPM	37	Traffic and press to NPO-NPN. CW.	CCT	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0810		KPH	2200	Press. CW. Good.	GCT	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7
0853		FFZ	750	Time sigs. and Weather. Spk.	PST	5	6	7	8	9	10	11	12	13	14	15	0	1	2	3	4	5	6	7
0900		JAA	15100	Press. CW.																				
0900		VAE	1700	Press. CW. Good.																				
1000		NPL	9798	Press to Navy. CW.																				
1000		XRT	600	‡Weather. Spk.																				
1100		JMAA	800	‡Weather. CW.																				
1100		WUT	1870	Press. CW. (Unreliable)																				
1110		JFRA	4000	‡Weather. CW. (2)																				
1159		JJC	7700	Time sigs. and ‡ Weather. CW.																				
1159		JCS**	600	Time sigs. and ‡ Weather. Spk.																				

1200 GBR 18740 Press. CW.
1200 NPM 11490 Time sigs. CW.
1200 VPS** 600 ‡Weather. Spk.
1230 JTJ 750 ‡Weather. Spk.
(3)

1255 BXY 2200 Time sigs. CW.
1300 NPC 2541 Weather. CW.
1300 VPS 2800 ‡Weather. CW.
1300 JDA 600 Weather. Spk. or
CW.

1330 HVM-HVI 600 Weather. Spk.
1355 NPO 5260 and 2677 Time sigs.
and Weather CW.

1400 FFZ 750 Weather. Spk.
1600 WWBO** 600 Weather. Spk.
(4)

1630 WNU 3331 Traffic and press.
CW. Good.

1700 NPG 7005 ‡Weather. CW.
1700 NPL 2883 Weather. CW.
1700 NPC 9798 Time sigs. CW.
1700 NPL 2541 Weather. CW.
1730 NPL 2939 Weather. CW.
1730 NPE 2677 Weather. CW.
1955 NPG 4836 and 2776 Time sigs.
CW.

2000 GBR 18740 Press. CW.
2000 NPM 11490 Traffic and press
to NPO-NPN.
CW. (7)

2000 WWBO** 600 Weather. Spk.
(4)

2100 NPC 2541 Weather. CW.
2130 NPE 2677 Weather. CW.
2230 NPM 5552 Weather. CW.
2355 NPM 11490 Time sigs. CW.

CW designates arc or tube.
Ships are especially cautioned not to interfere with the schedules marked with the double star.

‡—Indicates that the weather is sent only in code.

‡—Indicates that the code weather report is followed by a plain-language report. All of the weather codes used by the various stations are given on the following sheets.

Numbers in parentheses refer to the following:
(2)—JFRA Tokyo. After the finish of the 4000 meter transmission, JFRA repeats the plain-language portion of the report on 600 meters CW. This is the best Japanese weather report.

(3)—JTJ Kobe, repeats the report on 2650 meters CW immediately after finishing on Spk. Poor arc on 2650.

(4)—All Pacific Coast Light Vessels send weather at the same time. WWBO, WWBP, WWBQ, WWBU and WWBV.

(5)—KPH repeats the plain-language portion of NPG's Major Weather Bulletin and also repeats WWBV weather, first on 675 and then on 2200 meters CW.

(6)—XPI Pratas Island, repeats the report on 1450 meters CW, after finishing the 650 meter transmission.

(7)—Much of NPM's day traffic goes through on about 20 meters instead of 11490 meters as shown.

(8)—VAE repeats the report on 1700 meters CW. after the finish of the spark transmission.

Unless otherwise mentioned, the times given are in G.C.T. (Greenwich Civil Time). This can be converted to P.S.T., Pacific Standard Time, (time of 120th Meridian West) or to C.C.T., China Coast Time, (time of 120th Meridian East) by means of the tables below:

CCT 8 9 10 11 12 13 14 15 16 17 18 19 20

GCT 0 1 2 3 4 5 6 7 8 9 10 11 12

PST 16 17 18 19 20 21 22 23 0 1 2 3 4

CCT 21 22 23 0 1 2 3 4 5 6 7

GCT 13 14 15 16 17 18 19 20 21 22 23

PST 5 6 7 8 9 10 11 12 13 14 15

Read the columns vertically, thus: Midnight (0)

GCT is 8 AM. (8) CCT and 4 PM. (16) PST.

CCT, China Coast Time, is the standard time of Manila, Hong Kong, Shanghai and other China coast cities.

Weather Reports

For off-shore vessels, the best weather reports are the bulletins sent by NPG and JFRA. Both can be heard at good distances.

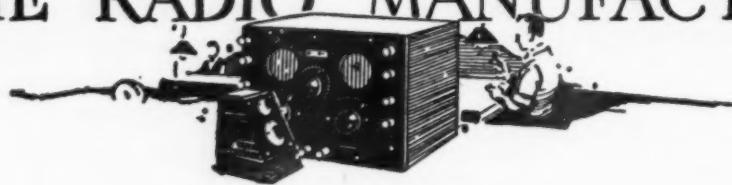
In the Orient it is a good plan to copy all NPO weather schedules as NPO usually has typhoon warnings a day or so in advance of other stations during the typhoon seasons.

Time Signals

Various methods of transmitting time signals are used in the different countries but an American "tick" is always available in the Pacific from either NPG, NPL, NPM or NPO. Other methods are explained in the Berne List.

(Continued on page 76)

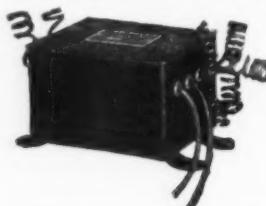
FROM THE RADIO MANUFACTURERS



THE CROSLEY BANDBOX

The Crosley Bandbox is a compact, attractive and sensitive six-tube set which is made in two types, one for battery or eliminator operation and the other for lampsocket connection for complete a.c. operation. The latter type uses a.c. filament tubes. The radio stages and the first audio stage use UX-226 tubes. Filaments in these tubes are heated with raw a.c. current at proper voltage. The UX-227, with indirectly heated emitter, is used as the detector. The power tube is a UX-171 at 180 volts plate. A small socket power unit supplies a.c. current at the proper voltage for all filaments and d.c. from rectifier and filter for all plates and grids including the UX-171 output tube at 180 volts. This unit is

The Dongan No. 4586 transformer is designed to supply low voltage filament current to the new UX-226 and UX-227 types of a.c. tubes. It will also function



with the UX-171 power amplifier tube. Another transformer, No. 4587, is required for the UX-210 tube.

The Hoyt Set Tester consists of a high resistance voltmeter and milliammeter in



finished exactly like the set. Both types are identical in size and, except for a few necessary differences, in construction. An unusual feature about the Bandbox is the fact that it is furnished in a frosted brown crystalline finish cabinet which can be readily removed, allowing the set to be inserted in a console or other piece of furniture. The chassis, independently mounted, may be released readily from its metal cabinet.

It has a single dial control. The tuning scale shows through a window which is illuminated, permitting the set to be used in a shadowy corner, a darkened room, or on a porch or other place where outside lighting may not be available. It has a volume control and filament switch, and two acuminators, or trimming condensers, for sharpening the circuits when extreme range sensitivity and selectivity are desired. It employs the Hazeltine Neutrodyne circuit consisting of three stages of completely balanced and neutralized tuned radio frequency amplification, detector, and two stages of improved transformer coupled audio frequency amplification. It is non-oscillating, non-radiating and completely shielded.

a neat case fitted with tube socket, switch, external binding posts for battery connection, and a 2 ft. flexible lead terminated with a plug to fit tube sockets. The meter has a 3 1/4 in. scale



in 4 ranges: 0-10 volts, 0-500 volts, 0-25 milliamperes, 0-100 milliamperes. As a voltmeter it has a resistance of 1000 ohms per volt. It may be used to test tubes, battery voltages, circuit continuity, etc.

The Electrad Truvolt is a high resistance power potentiometer for controlling the output of a "B" eliminator. It consists of a high resistance element wound on a threaded isolantite tube and a knob-controlled contact arm. The resistance



unit itself consists of nichrome wire closely wound on an asbestos cord having an enamelled copper core. The full length of base wire is exposed for the dissipation of heat. The units are rated at 25 watts in ranges of 0-2000 ohms to 0-50,000 ohms.

Sprague Midget Condensers, in 14 sizes from .0007 to .1 mfd., are tested to 1500 volts d.c. They are about 1/2 the size and 1/4 the weight of the usual fixed condenser. Tests have shown them to have an average breakdown voltage of 3550 and a minimum breakdown of 3000 volts a.c. They are made in two types, with either "eyelets" or pre-soldered flexible lugs. Constant capacitance is secured by a process of triple impregnation and an asphalt wrapping.

The Dubilier Condenser Corporation has announced that unauthorized use of their patents on battery eliminators, power amplifiers and power-operated sets will be prosecuted. Licenses have been granted to Willard, Balkite, Philco, Majestic, Federal Brandies, Argus, Timmons and the U. S. Government.

New Radio Catalogs—Bremer Tully Mfg. Co. of Chicago are distributing a new catalog sheet which illustrates and describes various models of their Counterphase Eight and Six, and gives the details of their speaker and "B" power unit.

Catalog No. 205 from the Benjamin Electric Mfg. Co. of Chicago shows their sockets for d.c. and a.c. tubes, shelf brackets, variable condensers and r.f. transformers.

The General Instrument Super "A" supplies 2 1/2 amperes of rectified and filtered alternating current at 6 volts for tube filament needs. The step-down power transformer secondary is tapped at "low," "medium" and "high" to care for variations in line voltages and cur-



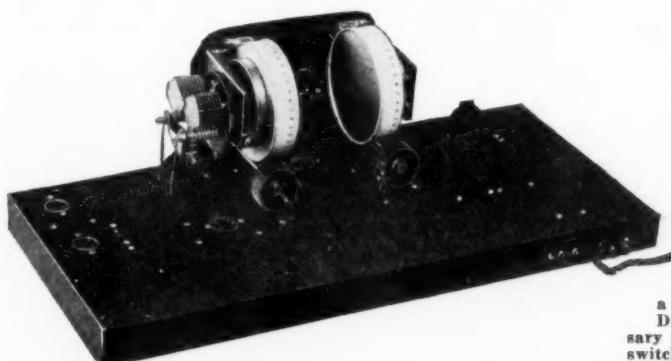
rent demand. A 2 1/2 ampere Raytheon cartridge is used as the rectifier. The power consumption at maximum load is 60 watts. The unit is 8 1/4 by 6 by 8 1/2 in. and weighs 21 lbs.

REMLER

INFRADYNE PARTS

The New 1928 Model

Easy To Build—Easy To Operate



Remler units are now available for assembling the complete Infradyne Radio Set. The new Radio Frequency Amplifier gives you a "front-end" that is simple, efficient and trouble-free. The Foundation Kit does away with the bother of purchasing numerous small parts and makes the construction of the set a genuine pleasure. Complete diagrams take all the guess-work out of wiring. Almost everybody knows that 1928 is an Infradyne year.

INFRADYNE FOUNDATION KIT

The No. 750 Infradyne Foundation Kit includes all the parts necessary for the construction of the 1928 Infradyne Receiver with the exception of the No. 700 Infradyne Amplifier, the No. 710 Radio

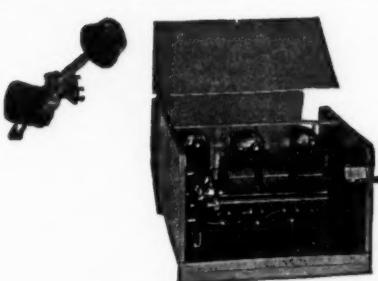
Frequency Amplifier, the No. 760 Cabinet and Base, audio and output transformers, voltmeter, tubes and batteries. The Foundation Kit contains a completely drilled, black-enamelled pressed steel base on which all units are to be mounted, a pressed steel instrument panel, a bronze control panel, Remler Drum Dials, Remler Type 659 Condenser, battery cable, special cable, all necessary sockets, fixed condensers, rheostats, jacks, binding posts, choke coils, switch, wire, screws and nuts. The Foundation Kit obviates the necessity of purchasing numerous small parts from many sources. Using the Foundation Kit, the novice can build the complete Infradyne in a few hours and he will be assured of a perfectly functioning receiver which is attractive in appearance. No. 750. Infradyne Foundation Kit..... Price \$52.00



REMLER INFRADYNE CABINET

The embossed copper cabinet, finished in two-tone brown crystalline enamel and the decorative wood base insure a finished appearance equal to that of the highest type of factory-built set.

No. 760..... Price \$15.00



REMLER R. F. AMPLIFIER AND ANTENNA COMPENSATOR

The No. 710 R. F. Amplifier incorporates two stages of R. F. Amplification and a detector. Entirely enclosed in a sheet copper case which gives complete electro-magnetic shielding. It is designed for single-dial control, either with the Remler Drum Dial or the ordinary 360° vernier dial. An Antenna Compensator, supplied with the Amplifier, nullifies the detuning effect of the antenna, which interferes with efficient operation in the usual single-control R. F. Amplifier. A Switch is provided for selective or non-selective tuning. Included in the Remler No. 710 Amplifier are special solenoid-type, small diameter coils; the Remler 3-in-Line Condenser; and Remler No. 50 Sockets.

No. 710..... Price \$55.00



REMLER INFRADYNE AMPLIFIER

A three-stage radio frequency Amplifier functioning at a fixed frequency of 3500 k.c. Provides high amplification of the received signal without marked increase in the background and makes possible enjoyable reception of distant stations. The No. 700 Infradyne Amplifier embodies the highest type of mechanical and electrical construction. The panel is of polished bakelite; controls and fittings of molded bakelite and nickel-plated brass. Enclosed in bright lacquered copper case.

No. 700 Infradyne Amplifier..... Price \$27.50

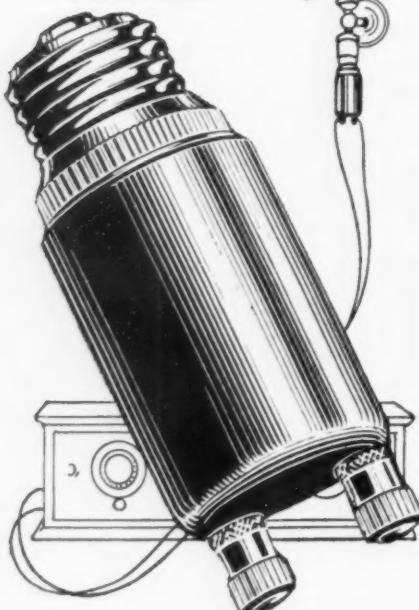
Remler Division of
GRAY & DANIELSON MFG. CO.

260 First Street, San Francisco
Eastern Warehouse: Elkhart, Ind.

Chicago

New York

Light Socket Aerial



**There's your
Aerial
and that's all there
is to it!**

Just connect it to the set and plug in! No "junk" out on your roof—no lead-in wires, switches or lightning arrester needed. A *Dubilier Light-Socket Aerial* and enough cord to reach the nearest A.C. or D.C. outlet brings in your favorite programs clean and clear throughout the year. Less static, less interference and no trouble at all when you use this remarkable little device. Uses no current—sold on a 5-day money-back basis. Price \$1.50.



A Still Better Micadon

A fixed condenser is such an inexpensive part of a receiver that you should insist on the best obtainable. Look over the new *Micadon* with its moulded Bakelite case, modern shape and its two-way terminals. Accurate to a degree and exceptionally durable. All standard resistances. Prices 45c to \$1.50.

Dubilier Condenser Corporation
4377 Bronx Blvd.
New York

Dubilier Condensers

THE TYRMAN TEN

(Continued from page 24)

connector strip is held in place by some of the screws of the audio transformers, which thus serve a dual purpose. The connector strip has holes drilled through the center, at uniform distances, so that the mounting screws can pass through without coming into contact with the connectors themselves.

In the pictorial diagram, Fig. 2, the connector strip is shown in sketch form, underneath the diagram, so as to enable a ready understanding of its purpose. The strip consists of six sets of eight terminals and two sets of four terminals, the latter being at the opposite ends. Of the sets of eight, there are four terminals on each side, being the $-A$, $-C$, $+B$ and $+A$. Both the negative A and positive B are double terminals, separated by insulation, so that one B terminal can be used for 45 volts, and the other for 90 volts, while the A pair of terminals can be used for different parts of the filament circuit.

Before placing on the subpanel, the strip is prepared in the following manner. The end terminals on each side are not used, so they are broken off. Do not clip them off with pliers, but work the terminals back and forth until they break off close to the bakelite moulded form. A number of the strips of the groups of eight terminals are also broken off, as shown in the diagram. Where the diagram reads "Lower," the upper strip associated with it is broken off, and where it reads "Upper," the lower strip is broken off. Where both strips are used, they are so indicated on the diagram. Particular care must be observed in the case of the last group of eight terminals to the right, where the positive B lower strip on the lower side is bent over in the form of an arc, and soldered to a connecting lug on the top of the strip after it has been placed on the subpanel. If care is not taken to bend this strip carefully, it may touch the broken end of the unused terminal on the top of the strip, and short circuit a section of the B battery. A small piece of paper or empire cloth placed under the strip at this point is a good precaution against such an occurrence. In some cases, the upper or lower strips are bent over and fastened to screws projecting through the center holes in the strip, as can be seen in the diagram, and the position of these terminals is indicated both in the drawing of the strip, and the pictorial diagram itself.

The two midget condensers are fastened to the subpanel by means of holes placed where the condensers will clear the rest of the apparatus, and the bypass condensers are fastened to the connector strip directly to the screws which act as connecting wires to the apparatus on top

(Continued on page 52)

Tell them that you saw it in RADIO



**Kept
Cool!**

*Like an Air-Cooled
Engine*

TRUVOLT

*An All Wire
Variable Voltage
Control*

TRUVOLT, a wire variable high resistance of special mechanical construction, is air-cooled on the same principle as Lindbergh's transatlantic motor. This results in a greater radiation area and adapts it especially for B-Eliminators and power devices.

1. Made entirely of wire; permanently accurate; long life.
2. Permits potentiometer control; positive metallic contact at all times.
3. Nichrome wire resistance—very low temperature coefficient. Wound on an asbestos-covered enamel core.

Type	Ohms	Milliamperes	Current
T - 5	0 to 500	224	
T - 10	0 to 1,000	158	
T - 30	0 to 2,000	112	
T - 50	0 to 5,000	71	
T-100	0 to 10,000	50	
T-200	0 to 20,000	35	
T-250	0 to 25,000	32	
T-500	0 to 50,000	22.5	

Eight stock types with resistances up to 50,000 ohms. All rated at 25 watts.

List \$3.50 each

Also full line of fixed wire resistances.

Write for free resistance booklet.

**"This is an
Eliminator Year"**

Dept. 16, 175 Varick Street, New York

ELECTRAD

All Electric Radio

Single Dial 7 Tube Set ~ 30 Days Free Trial

Agents!
Dealers!
Big Profits!

Make Big Money taking orders for Metrodyne—
all or part time. Metrodyne All Electric Radios are in a class by themselves. Unequalled for quality, performance and price. Demonstrate at home and take orders. Lowest wholesale prices. Your Demonstrating Set on 30 days' FREE trial. Mail the coupon below for complete details.



GORGEOUS CONSOLE ELECTRIC RADIO

Here is the Metrodyne All Electric Console Radio—a gorgeous, genuine walnut cabinet, in a beautiful two-tone finish. Has a built-in genuine Metro-Cone large size speaker. Brings in programs with great volume, reproducing the entire range from the lowest to the highest notes with remarkable clearness and distinction. All metal parts are finished in old gold. Wonderful electric radio, in a cabinet that will beautify the appearance of any home.

BEAUTY — EFFICIENCY DEPENDABILITY

The Metrodyne All Electric table model Radio is a 7 tube, single dial set. Only the highest quality low loss parts are used throughout. Solid walnut cabinet, beautiful two-tone effect, with handsome gilt metal trimmings. Size of cabinet, 28 inches long, 13 inches deep, 10 inches high. Has electrically lighted dial—easy to log stations, even in the dark. Only one dial to tune in all stations. Excellent tonal qualities—wonderful volume—very selective.

METRO ELECTRIC COMPANY

2165 N. California Ave. Dept. 642 Chicago, Illinois

Three Year Guarantee

Metrodyne

ALL ELECTRIC RADIO

"Simply
press the
switch button
and it's on"

no

A Batteries
B Batteries
C Batteries
Eliminators
Chargers
Acids

30
DAYS
FREE
TRIAL

We are one of the pioneers of radio. The success of Metrodyne sets is due to our liberal 30 days' free trial offer, which gives you the opportunity of trying before buying. Thousands of Metrodyne sets have been bought on our liberal free trial basis—Write Today!

FREE TRIAL COUPON

METRO ELECTRIC COMPANY
2165 N. California Ave., Dept. 642
Chicago, Illinois

Gentlemen:

Send me full particulars about Metrodyne All Electric Radio and your thirty days' free trial offer.

Name _____

Address _____

If you are interested in AGENT'S proposition place an "X" in the square →

There is a Vitrohm Radio Resistor for EVERY power unit

More than 90 standard Vitrohm Resistors and Rheostats cover the resistance need of every socket power circuit now on the market.

Resistance is the heart of power circuits. Make sure of quiet, permanent, and unfailing service by insisting on Vitrohm for radio.

Vitrohm Resistors and Rheostats are guaranteed unconditionally for continuous-duty in any circuit where they operate within their watts dissipation rating—Vitrohm Resistors have the highest continuous-duty rating without resistance change of any resistor.

New Vitrohms

The list below of new resistors and rheostats is partial. A full description of new Vitrohms for Radio is available without charge. Send for it.

RAYTHEON 350 M. A. UNITS
Vitrohm Resistor 507-70 \$8.75
Vitrohm Rheostat 507-59 5.50

QRS 400 M. A. CIRCUITS
Vitrohm Resistor 507-62 \$8.75
Vitrohm Rheostat 507-59 5.50

SILVER- MARSHALL UNITS
Vitrohm Resistor S-M 653 \$2.50
Vitrohm Resistor S-M 655 2.50
Vitrohm Resistor S-M 657 5.00

THORDARSON POWER PACKS
Vitrohm Resistor for R-171 \$2.15
Vitrohm Resistor for R-210 2.65
Vitrohm Resistor for R-210 with UX874 Regulator Tube 4.90

The Adjustat

A new Vitrohm Rheostat, dissipating 20 watts, having 15 steps of resistance. The Adjustat is priced at \$3.00.

11 types are available in the following resistances and current capacities:
507-79, 1 ohm, 4 amp.—507-71, 2 ohms, 3 amp.—507-72, 6 ohms, 1.5 amp.—507-73, 20 ohms, 1.0 amp.—507-74, 30 ohms, 0.75 amp.—507-80 50 ohms, 650 m.a.—507-81, 600 ohms, 180 m.a.—507-75, 1000 ohms, 125 m.a.—507-76, 2250 ohms, 90 m.a.—507-77, 10,000 ohms, 40 m.a.—507-78, 25,000 ohms, 10 m.a.



WARD LEONARD
ELECTRIC COMPANY
MOUNT VERNON, N. Y.

(Continued from page 50)

of the panel. The battery leads are brought out to a connector plug, which has the two loud speaker tip jacks mounted alongside the plug connector, as can be seen in the pictorial diagram. The position of the relatively few connecting wires required in the set is plainly shown in the diagram, so that no special instructions are needed.

The wiring of the subpanel can be practically all completed before the panel is fastened to the front panel assembly, the only wires which are required being those to the tuning condensers and panel rheostats, which can be placed in a few minutes. The two panels are fastened together by means of a pair of brackets, at each end.

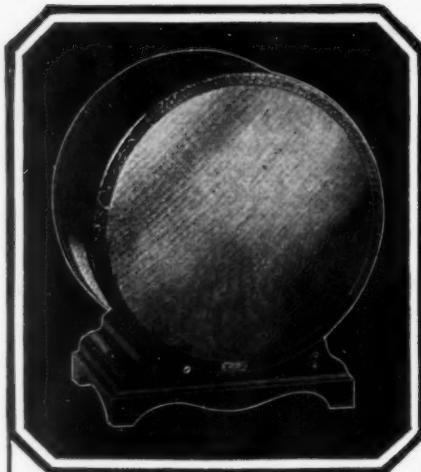
The first test to make after all connections are made and checked with the diagram is to make certain that there are no short circuits in the battery leads. A favorite method of making this test is to insert a tube in each socket in turn, with the positive *A* battery lead connected to the various *B* battery positive taps, so that if the filament lights, a short circuit between the positive *A* bus bar and some of the *B* battery terminals is present. Of course, a dead short in the *A* battery circuit will be indicated by a snappy spark when the storage battery or *A* socket power is connected. The safest method of insuring against tube burnouts, when a dry cell or storage *B* battery is to supply the plate voltage, is to place a 10 or 25 watt Mazda lamp in series with the negative *B* battery wire, so that should there be a short circuit, the lamp will light, and permit only $\frac{1}{4}$ ampere or so to flow into the circuit. The lamp can be left in the circuit as a permanent fuse if it is shunted with a 1 mfd. bypass condenser. Place the lamp at the battery, not at the set.

Upon completing the tests, insert all tubes in their sockets, and place the shields over the tubes, grounding the second and third shields from the left, looking at the set from the front panel, with the flexible wires leading from the ground connection.

Be sure that the *C* batteries are connected, especially that of the power tubes, as their plate current will be excessive if the grid circuit is open, and they will quickly become overheated, besides running down the batteries at a rapid rate.

To tune the set, turn on the filament rheostat-switch and adjust the rheostat to about the half-way position. Turn the volume control rheostat slowly until the set appears to be sensitive, and then turn the drum dial controls quickly back and forth with the scales at the same settings, until a station is picked up. Then adjust carefully for maximum

(Continued on page 54)



You Will Marvel at the
Tone Reproduction of the

Temple Drum Speaker

(Long Compensated Air Column)

People are positively astonished when they hear the TEMPLE SPEAKER for the first time. The marvelous clarity and purity of tone is amazing.

The TEMPLE SPEAKER brings new joy in radio. Thruout the entire musical scale this super-speaker is sensitive beyond comparison—un-equalled for tone quality. Dance music—organ recitals—opera—hear them now in a way you never dreamed was possible!

Not a Cone

Regardless of the kind of radio set you operate, the TEMPLE SPEAKER will greatly improve its reception due to its long compensated exponential air column Temple construction. The best set made will not give satisfactory results unless accompanied by the right speaker.

Test the TEMPLE by comparison. Any Temple Dealer will be glad to give you a home demonstration with a Temple comparator.

CONSOLE CABINET MODEL No. 65—priced at \$65.00; west of Rockies, \$75.00

DRUM TYPE MODEL No. 13—13 inch—priced at \$29.00; west of Rockies, \$32.00

DRUM TYPE MODEL No. 18—18 inch—priced at \$48.50; west of Rockies, \$55.00

If your dealer cannot supply you write for complete information and name of our nearest Temple dealer

TEMPLE, Inc.
213 S. Peoria St., Chicago, Ill.
LEADERS IN SPEAKER DESIGN

J. P. Hermans Co Pacific Coast Distributors
585 Mission St., San Francisco

Tell them that you saw it in RADIO

Announcing New and Improved AERO COIL SUPER-SENSITIVE INDUCTANCE UNITS



The Improved AERO Universal Coil

At last—a true universal coil. This improved coil is suitable for any straight tuned radio frequency circuit, both bridge and loss balance. It is easily and ideally adaptable to 3, 4, 5, 6 or 7 tube sets and can be used with all types of tubes—201-A, 199, 112, and the new 240 tubes and A. C. tubes. Sharp selectivity, true tone quality, distance and volume, to a heretofore unknown degree, are assured where these coils are used. For that reason the improved Aero 6, Aero 7, Aero 4, and other circuits built around these coils will be more popular than ever during the coming season.

NEW AERO KITS Employing the Improved AERO Universal Coil



Code No. U-16

The AERO Universal Tuned Radio Frequency Kit Kit of 4 Coils (For Improved Aero-Dyne 6)

Kit consists of 4 twice matched units—adaptable to all standard tubes. Tuning range below 200 to above 550 meters. This kit will make any set better in selectivity, tone and range. Will eliminate losses and give the greatest receiving efficiency. Each kit is carefully matched at both ends of the broadcast range.

For .0005 Condenser, Code No. U-16.....Price \$15.00 For .00035 Condenser, Code No. U-163.....Price \$15.00

The AERO Universal Tuned Radio Frequency Kit Kit of 3 Coils (For Aero-Seven)

Consists of 3 twice matched units. Coils are wound on Bakelite skeleton forms, assuring a 95% air dielectric. Range from below 200 to above 550 meters. Each kit carefully matched at both ends of the broadcast range.

For .0005 Condenser, Code No. U-12.....Price \$12.00 For .00035 Condenser, Code No. U-123.....Price \$12.00

AERO Universal 3-Circuit Tuner



In the form of a 3 circuit tuner with a fixed tickler, this Aero Coil will improve any circuit. Adaptable only to 201-A, 199, 112, or the new A. C. Tubes. Has variable primary for governing selectivity.

Code U-55 (for .0005 Condenser) or Code U-553 (for .00035 Condenser).....Price \$4.00

AERO Radio Frequency Regenerative Kit



The supersensitive kit used in the new Aero 4 and The Chicago Daily News Receiver will improve the efficiency of any circuit for use with 201-A, 112, 199, and the new A. C. Tubes. Used as .0005 variable condenser to tune fixed tickler. Code U-95 (for .0005 Condenser) or Code U-953 (for .00035 Condenser).....Price \$8.00

AERO Universal Antenna Coupler



A highly efficient low-loss and antenna coupler with variable primary, adaptable to 201-A, 199, 112, 240 and the new A. C. Tubes.

Code No. U-96 (for .0005 Condenser) or Code No. U-963 (for .00035 Condenser). Price \$1.50

AERO Universal Wave Trap Unit

Makes an excellent wave trap due to low distributive capacity and low high frequency resistance. Helps greatly in eliminating interference. Can also be used to improve efficiency of Crystal Sets.

Code No. U-4 (for .0005 Condensers) or Code No. U-43 (for .00035 Condenser).....Price \$4.00

AERO Choke 60

Has uniform choking action over a wide range of wave lengths. Eliminates customary "holes" in the tuning range—so common with ordinary chokes. You will find the Aero Choke 60 perfect in every respect.

Price each\$1.50



AERO Short Wave Kit



Kit consists of 3 coils and base mountings. Code No. L. W. T. 125.....Price \$12.50

The most efficient and kit ever offered. Com-satisfactory short wave pieletly interchangeable, and covers U. S. Bands range 15 to 130 meters.

An interchangeable Transmitter Kit at last. Kit 2040-K has range of 16.5 to 52 meters. Kit 4080-K has range of 36 to 90 meters. Kit includes two mounting bases and two choke coils that are interchangeable.

Price (each kit).....\$12.00

AERO Transmitter Kits

Designed for use with Aero Transmitter Kits and other circuits. Prevents a high impedance over usual amateur wave lengths.

Price each\$1.50



IMPORTANT NOTICE

We furnish foundation units, drilled and engraved by Westinghouse Micarta for the Aero Short Wave, Aero 6, Aero 7, Aero 4, Aero Transmitter, and The Chicago Daily News 4 tube circuits. This is a special service for the home set builder. Full working blue prints with each unit. Dealers may secure samples of blue prints to show their trade for 25c each.

Any of these Aero Kits, Coils and Chokes should be available at your dealer's. If he cannot supply you, order direct from the factory. Be sure to specify code or key numbers when ordering.

AERO PRODUCTS, Inc., Dept. 111
1772 Wilson Avenue Chicago, Ill.

Hoyt

Model 300
RADIO SERVICE
SET TESTER



Makes All Tests On Any Radio Set

Equipped with precision voltmeter, 1,000 ohms per volt with $3\frac{1}{2}$ inch hand-calibrated 4-range scale—0-10 and 0-500 volts,—25 and 100 M. A. Cased in polished hardwood box with cover and leather carrying handle.

Price, complete with Adapters, \$65.

Send for new Radio Catalogue P-10

BURTON - ROGERS CO.

Sole Selling Agents
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\$1.00 BRINGS "RADIO"
TO YOUR HOME FOR THE
NEXT SIX MONTHS

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The Blue Ridge
7"x18"x10" Mahogany
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Send us your order or
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full information. 12
hour service, factory
to you.

Southern Toy Co. Inc.
MANUFACTURERS
HICKORY, N.C.

(Continued from page 52)

volume, and reduce the volume in the case of a local station by means of the volume control knob, until the power amplifier is not overloaded. Stations will be heard at only one point on each dial, which is a feature of no small importance in present-day broadcast reception in large cities.

The two midget condensers are adjusted when the set is tuned to about 240 meters, and when the point is found where the set will just barely oscillate, back off the condensers slightly and let their adjustment remain fixed at that point.

The right hand dial will be found very sharp in tuning, and a little practice will be required to find the spot where the tone quality is best, and the station is tuned to its maximum volume. If local stations seem weak, even with the volume turned up full, it may be that the capacity coupling between the oscillator and the mixer tubes is not large enough and the condenser should be adjusted until the right degree of volume is obtained. The same applies to the setting of the antenna series condenser, which will require adjustment to suit the individual antenna system.

Due to the uniform construction of the r.f. transformers, the twin condenser, which is also very uniform in capacity setting, will not need a trimmer condenser across one of its sections, but in case there seems to be a broadness of tuning of the left hand dial, an adjustment is provided on each condenser so as to compensate for slight differences in the tuning adjustment of each r.f. coil.

On the top of each variable condenser is a set of two lock nuts, which may be loosened slightly, so that by pressing gently against the terminal screw of the stator plates, with a pencil or other insulating medium, the position of the stator plates may be varied slightly with respect to the rotors, and with a distant station tuned in, the two condensers can be lined up perfectly. After they are lined up properly, tighten the nuts, and no further adjusting is needed. No trimmer condenser will be required, as the coils are sufficiently well matched, over the entire wavelength band.



The AmerTran Power Transformer
Type PF-281, \$25.00 each

New Transformers for AC Power Supply

A in audio transformers, AmerTran products stand first in the power transformer field. They are up-to-date in design, well-made and dependable.

Type PF-281, illustrated above, becomes virtually an A - B - C eliminator when used with AC tubes and the proper filter circuit for DC voltages of from 425 to 650 volts, plate current 110 milliamperes. This unit is designed for use with the new UX-281 rectifying or 216-B rectifying tube. In addition, there are filament heating windings for the new AC tubes. Therefore, this single unit will convert AC house current into filament and plate current, and grid bias potential. Used with types 709 and 854 AmerChokes in the filter circuit, a receiver may be constructed to operate entirely from the house lighting circuit.

Type H-67 Heater Transformer is a new unit recommended for use with the RCA UX-226 raw AC amplifier tubes and the UY-227 detector tube. It also has a third filament winding capable of handling two UX-171 tubes. In connection with the new AC tubes, type H-67 becomes the power source for the filament and is therefore a real "A" battery eliminator. This transformer sells for \$12.00.

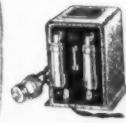
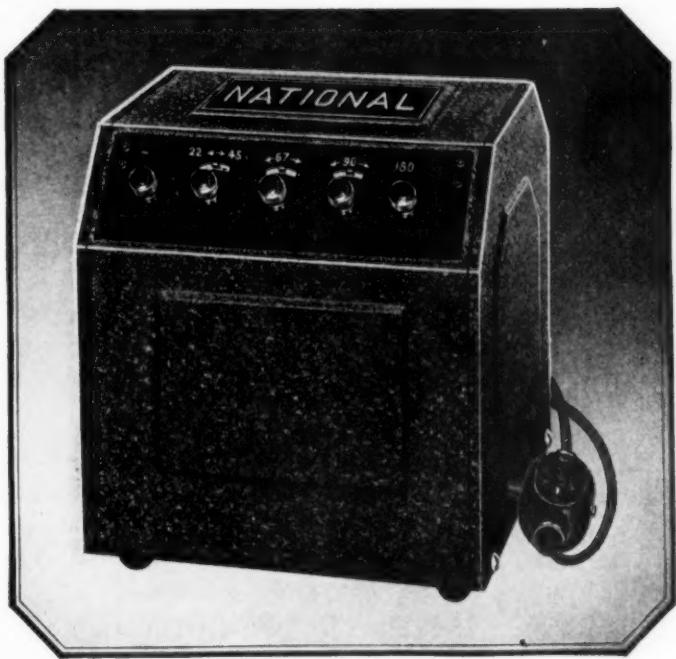
Write for booklet, "Improving the
Audio Amplifier," and data on
Power Supply Units.

AMERICAN TRANSFORMER CO.
178 Emmet Street Newark, N. J.
Pacific Coast Office:
CHRONICLE BLDG., SAN FRANCISCO

We also make Audio Transformers,
Choke Coils and Resistors

Transformer Builders for -
Over Twenty-Six Years

NATIONAL



AN ENTIRELY NEW & UNIQUE
HEAVY - DUTY BETTER-B
Supplies detector voltages from 22 to 45, adjustable; R. F. voltages from 50 to 75, A. F. voltages from 90 to 135, Power tube voltage 180; fixed tubes and by-pass condensers are protected against excessive and harmful voltages. An exclusive feature.

DESIGNED FOR LASTING
SERVICE WITH LIBERAL
FACTORS OF SAFETY.



A STRICTLY HEAVY - DUTY POWER UNIT

Output rating is 70 mils at 180 volts. Uses R.C.A. UX-280 or Cunningham CX-380 Rectron. Licensed under patents of Radio Corporation of America and Associated Companies. For 105-115 volts, 50-60 cycles A.C.

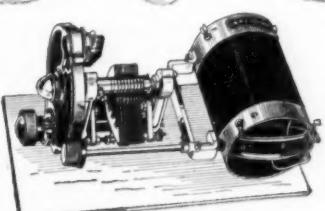
List price with cord, switch and plug, \$40. Rectifier Tube, \$5. Write National Co. Inc., W. A. Ready, Pres., Malden, Mass. for new Bulletin P.

NATIONAL - B

Type 7180

A "B" That's Built for Service

At Booth 5—Section F. F., New York Radio World's Fair—Booths 94 and 95 Boston Show



ACME
Celatsite
Wire

Tinned copper bus bar hook-up wire with non-inflammable Celatsite insulation, in 9 beautiful colors. Strips easily, solders readily, won't crack at bends. Sizes 14, 16, 18, 19; 30 inch lengths.

Flexible Celatsite for sub-panel wiring
A cable of fine, tinned copper wires with non-inflammable Celatsite insulation. Ideal for sub-panel or point-to-point wiring. Strips easily, solders readily. Nine beautiful colors; sold only in 25 ft. coils, in cartons colored to match contents.

Spaghetti Tubing
Oil, moisture, acid proof; highly dielectric — used by leading engineers. Nine colors, for wire sizes 12 to 18; 30 inch lengths. (We also make tinned bus bar, round and square, in 2 and 2½ ft. lengths.)

Stranded Enameled Antenna
Best outdoor antenna you can buy. Seven strands of enameled copper wire. Presents maximum surface for reception, resists corrosion; this greatly improves the signal. Outside diameters equal to sizes 14 and 16. (We also offer solid and stranded bare, and stranded tinned antenna.)

Loop Antenna Wire
Sixty strands of No. 38 bare copper wire for flexibility, 5 strands of No. 36 phosphor bronze to prevent stretching. Green or brown silk covering; best loop wire possible to make.

Battery Cable
A rayon-covered cable of 5, 6, 7, 8 or 9 vari-colored Flexible Celatsite wires for connecting batteries or eliminator to set. Plainly tabbed; easy to connect. Gives set an orderly appearance.

Send for folder
THE ACME WIRE CO., Dept. R
New Haven, Conn.

ACME
WIRE
MAKES BETTER RADIO

THE MISFIRE

(Continued from page 27)

the road under cover, actually surrounded by the lookouts, for the last twenty-four hours.

"Now listen closely. The real reason that I am assigning you to this job is this: Lefty Blackburn is aboard that ship, and he is coming ashore with the liquor. He has had all he wants of Canada, is probably homesick, and figures that last killing job of his is ancient history, and that he is safe in coming back. He has grown a beard, and has gotten rid of those two gold crowns in the front of his mouth. Never mind where I got the tip—I figure that you would like to make connections with Lefty, and of course we would like to get him.

"Oh, yes, about Raule—leave him in the car when you park. He is green yet and there may be some shooting. You will call the desk sergeant tomorrow morning and report sick. Raule will pick you up about four o'clock in the afternoon, which will bring you to the place shortly after dark. Raule will call you up early in the afternoon and tell you the meeting place."

Dawson's indignation at being sent out on the job with Raule was tempered by the chief's mention of Blackburn. Some nine months previous, he and Lefty Blackburn had shot it out, Dawson getting two .38 calibre slugs, one in the shoulder, the other in the right arm. Blackburn, dope crazed, had run amuck, killing a victim, and tracked down by Dawson, had turned and put over a spectacular bit of gun play. The feud between the two was several years old, Blackburn having served time because of Dawson's activities. Dawson was wounded so that he could not fight back, Blackburn made good his escape, and eventually, it was believed, found his way into Canada. Now it seemed that there was a chance to even up the affair, and Dawson, not possessed of touchy nerves, welcomed the opportunity.

The following afternoon, Raule picked Dawson up at a downtown corner. Dawson looked like a prosperous elderly business man, clad in an immaculate gray suit—even his oversized feet seemed to have shrunk in the new arrangement. Raule had likewise rid himself of his faint suspicion of a mustache and wore a chauffeur's uniform, from shiny puttees to a nifty cap. Differently he stepped out at the curb, saluted smartly, and swung the door open. As Dawson entered, stooping down the better to accommodate his height, he stumbled across a square, polished box.

"Whatcha got in the package?" queried Dawson as Raule threaded his way through the downtown traffic.

"That," replied Raule, "is an eight-tube superheterodyne—a radio," he



Accurate rating, permanent capacity value, high D. C. resistance — low self inductance are characteristics of Sangamo Mica Condensers.

In addition, they are easy to use!

One may solder directly to the terminals, or pass bus-bar through them, use lugs, or mount the condenser with machine screws — all with the knowledge that the condenser will not be injured and that connections are permanent!

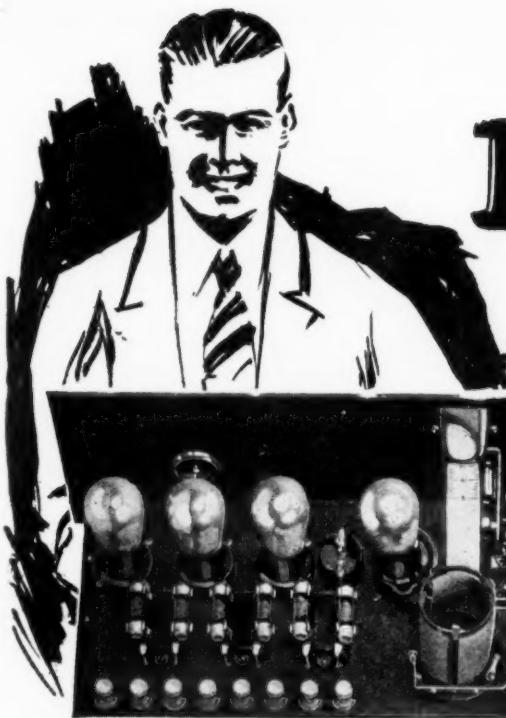
6336-5

Sangamo Electric Company
Springfield, Illinois

SANGAMO
MICA CONDENSERS



Tell them that you saw it in **RADIO**



AERO-SEVEN RECEIVER

10-Kilocycle Selectivity

Utilizing
New 340
Tubes

Unique Features

The Aero-Seven Receiver, which is being featured in the prominent radio magazines and newspapers, is a new tried and tested tuned R. F. circuit, incorporating the most modern radio improvements at a popular price. It is a distinct innovation in a tuned R. F. receiver, utilizing three stages of R. F. and three stages of resistance-coupled audio. Circuit is built around the famous improved Aero Universal Coils, with improved Amsco S. L. tuning 3-gang condenser, S-M single-control drum dial and the tried and tested parts of other famous manufacturers. Such names as Carter, X-L, Westinghouse, Aero, Amsco and Silver-Marshall assure you of a circuit that is the final word in perfection.

Distinct features are: the new Hi-Mu tube at input and in R. F. stages, potentiometer control, higher amplification, 10-kilocycle selectivity and **true** single control.

The Aero-Seven has a broadcast range from below 200

New and Unique Hookup 3 Stages of Radio Frequency 3 Stages of Audio Amplification

The Aero-Seven has a new and unique hook-up that incorporates three stages of R. F. and three stages of Audio. There are two stages of tuned radio frequency and a special coupling stage, the secondary function of which is to prevent antenna detuning, thereby giving single control which is both theoretically and practically perfect. This independent antenna circuit is of a new and efficient design and employs a resistance connected between the antenna and ground inputting to the first grid circuit. Five CX340 tubes are used—3 in the R. F. circuit, one detector and one in the audio.

In the three audio stages, one 171 power tube is used, one 201A tube and the one CX340 tube in the input.

The circuit, therefore, is different from the usual 7-tube R. F. circuits, which variations contribute to its optimum selectivity, perfect quality and thrilling volume.

The combination of all the various parts, the matching of the Aero Universal Coils, together with the Amsco compensating 3-gang condenser, with true single control and potentiometer control, greatly simplifies operation and tuning, while adding efficiency to the circuit.

First Use of New CX340 Tubes— 1-6/10 Times Better

Utilizing the new CX340 Cunningham tubes in place of the usual 201A, gives the Aero-Seven the distinction of being the first circuit using this superior method. CX340 tubes are 1-6/10 times more effective than 201A tubes, having a 5-volt filament and .25 amperes; plate, 180 volts maximum. In this receiver 90 volts is used constantly on the plate for the R. F. circuit, something seldom attempted but efficiently worked out here. It is a High Mu tube, having a high amplification factor (Mu-30) and is used both as a detector and as a radio and audio amplifier. The Aero-Seven is specially designed to operate with this new and better CX340 tube and the results secured will be a pleasing revelation to you. It is surprising what tone and volume is secured with a minimum use of current.

Resistance Coupled Audio Amplification

Resistance coupled audio amplification in the Aero-7 attains a quality of reproduction unapproachable in other systems. It preserves the extraordinary quality consistently achieved by Aero-7's 10-kilocycle selectivity.

meters to over 550 meters (1500-500 kc) and requires no shielding as with the small Aero coils, direct pick-up is negligible and coupling between coils is the very minimum. The coils are twice-matched at both high and low frequencies of the broadcast band, thus eliminating many difficulties in single dial control and overcoming one of the principle causes of disappointments.

The adjustable compensators on the Amsco condensers facilitate the equalization of circuits, solving the major problem of tandem tuning.

The extremely sharp selectivity of the Aero-Seven circuit is due to the low resistance of the coils. The high voltage gain per stage, due to the extremely low loss construction, assures extreme distant reception and greatest volume and sensitivity is assured through the high efficiency of the coil windings.

10 Kilocycle Selectivity Now a Real Fact

Ten kilocycle selectivity is OPTIMUM Selectivity. It means a receiver that tunes sharply enough to eliminate interference and yet does not tune so sharply as to cause distortion. It is the ideal tuning characteristic. "Optimum tuning," says the engineer, when he means a perfect set.

Why bother with anything but the best? Why put up with anything but 10-kilocycle selectivity, as represented in the Aero-Seven circuit?

Due to the low-loss construction of the coils and condensers in the Aero-Seven and the great selectivity introduced into the circuit itself, you get selectivity so sharp that you cannot get two stations at one time under present broadcast regulations, at the same time providing adequate frequency margin to prevent high "cut off"—distortion.

Imagine what this means in perfect radio reception. Selectivity, the ability to tune in clearly, sharply, without fear of disturbance in getting the station you want whenever you want it—that's something every radio fan has long desired. It is an actuality in the Aero-Seven—a feature that is necessary in an up-to-date circuit—a feature that you get in the Aero-Seven when you build it.

New, Modern, Proved Features in Aero-Seven

10 Kilocycle selectivity.
Resistance coupled amplification.
Uses new CX340 tubes instead of 201A.
3 stages of R. F.
3 stages of audio amplification.

Extreme D-X reception.
Potentiometer control.
Silver-Marshall single drum dial.
True single control.
Aero Coils are twice matched at both high and low frequencies.

Amsco adjustable condensers.
Carter resistances.
Westinghouse Foundation Unit.
X-L Posts.
High quality parts throughout.
Range below 200 to above 550 meters (1,500-500 KC).
Low loss characteristics throughout.

See article
in this issue

Aero Products, Inc.
Dept. 509 1768 Wilson Ave., Chicago.

Dear Sirs: Enclosed find 10c for which please send me life-size blueprints, assembly diagrams, construction data and all the facts in building the new Aero-Seven Receiver.

Name

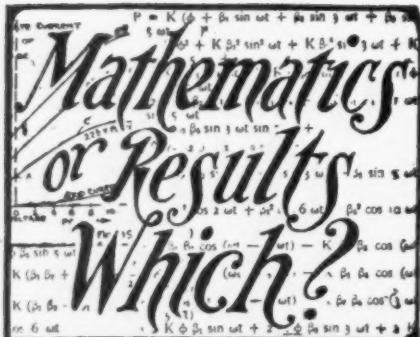
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ASSOCIATED MANUFACTURERS—Amsco, Aero, Carter, Westinghouse-Micarta, Silver-Marshall, X-L

Tell them that you saw it in RADIO



YOU can't get away from "variables" in the radio power unit. Line voltage fluctuations, changes in receiver tubes, differences in rectifier tubes, lowered output with age, unequal drain for different yet inter-related circuits—well, there are many "variables" present and for which you must compensate with suitable resistance values.

Of course, if you are an expert mathematician and engineer, preferring to work the slide rule than to enjoy radio programs, then by all means get the fun out of figuring the necessary resistance values. And don't forget to change the resistors from time to time to compensate for the changing conditions.

But if you are just the average radio enthusiast, seeking the best results with the least troubles, then use variable resistors to take care of all "variables." And when you say variable resistor—that means

CLAROSTAT

CAUTION—Clarostat is being imitated. Look for the name stamped on the shell

GET THE FACTS! Ask your dealer regarding Clarostats and how you can apply them in that new or old radio power unit. Better still, send a quarter for our big 32-page book "The Gateway to Better Radio," which contains a vast fund of information on radio in general.

AMERICAN MECHANICAL LABORATORIES, INC.

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The Power Clarostat

A husky for handling real power. In several turns of knob, it covers wide range. Handles up to 40 watts. In three resistance ranges—0 to 10 ohms; 25 500 ohms; 200 to 100,000 ohms. Price \$3.50.



The Standard Clarostat

The ideal B-voltage tap control, providing the precise voltage for each circuit and for any type of tube. Universal resistance range of from practically 0 to 5,000,000 ohms, with a current carrying capacity of 20 watts. Noiseless, non-packing, foolproof and indestructible within its working capacity. Price \$2.25.



amended at the sight of Dawson's puzzled countenance, at the same time adding mentally, "and I hope those big feet of yours didn't crack those 199 filaments."

"Oh," said Dawson, a trifle contemptuously, as he settled back comfortably, and bit off the end of a four bit cigar which he had bought to fit the gray suit, "a radio, huh? Whatcha going to do with it—throw it at the bootleggers, maybe?"

"Hardly," replied Raule, somewhat nettled at Dawson's tone, "but the chief says I have to stick with the car, and I figured it would be a good way of killing time while you are out handcuffing your prisoners."

Dawson grunted and lapsed into silence. The car swung into its stride, threading the now narrowing road. They slid through small coast villages, at times in a burst of speed, again more slowly as Raule navigated one of the many curves. Finally Dawson leaned forward and tapped Raule on the shoulder. It was now growing dark, and Raule switched on the headlights.

"Take it easy," said Dawson, "we ought to be coming to the Jensen ranch at any time."

Ahead of them the lights of a heavy truck loomed, at right angles to the road, emerging from a side lane. Covered with a heavy tarpaulin, it moved squarely across the road as Raule slid his car to a protesting stop some fifty feet away. The motor of the truck died suddenly, the driver getting out and cranking vigorously. From the driver's seat another figure clambered down, stood watching the driver a moment, and then slowly walked toward the sedan.

"On your guard—this may be a plant," muttered Dawson as the man, a burly hulk, approached.

Raule lowered the window on his side of the car as the man came up. "Trouble?" he asked.

"Yep," said the fellow, "motor's been bucking with that heavy load of artichokes. He'll have her going in a minute and I'll get out of your way. Got a match on you?" Raule passed him a match, and talked indifferently, while Dawson, surrounded by fake luggage, glanced impatiently at his watch, inwardly noting with approval that Raule was carrying his part well. Dawson was aware that both Raule and himself were being closely scrutinized by the man beside the car. Suddenly the motor of the truck started with a roar, and nodding to Raule, the man made his way back to the truck and clambered up beside the driver. The truck backed into the lane, and the driver motioned Raule to pass.

"Artichokes my grandmother," grunted Dawson. "Do you know who that guy was you were talking to. Well, (Continued on page 60)

ABC Powerizer

makes every set a DeLuxe electric ~

Alternating current flows uninterruptedly into new A.C. Radiotrons in set ~ Finest tone quality in radio

NOW you can have any radio set powerized—all ready to plug into light socket. No batteries, jellies, trickle charger eliminator units. Alternating current direct to A.C. Radiotrons in set is the only practical scientific method of electrification.

Deep bass notes—vibrant chords of the organ—are reproduced with the richness and mellow ness achieved only by powerized amplification.

Write for literature explaining details of real A C socket-power and tone quality.

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Atwater Kent Model—List without tubes \$60.00. Radiotrons UX-280 and UX-210, \$14.00.

Universal Model—for majority of 6-tube RFL and Neutrodyne circuits. Without tubes \$60.00. Radiotrons UX-280 and UX-210, \$14.00.

Radio "20" Model—List without tubes \$59.00. Radiotrons UX-280 and UX-210, \$14.00.





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Radio Cabinet and Bench

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touch of elegance. Ample space inside of cabinet for all batteries, chargers and eliminators. Keep all unsightly accessories out of sight in this splendid piece of furniture. Made of well seasoned, selected hardwood in **Handsome Walnut Finish**. Two large, French style swinging doors at front with ornamental brass knobs. Front panels of doors in carved panel effects and legs of both cabinet and bench are neatly turned. Edge of top neatly bevelled. Cabinet has lower cross brace to insure rigidity. Top is 33 $\frac{1}{4}$ x 18 inches, height inside 11 $\frac{1}{2}$ inches. Bench is 18 inches high.

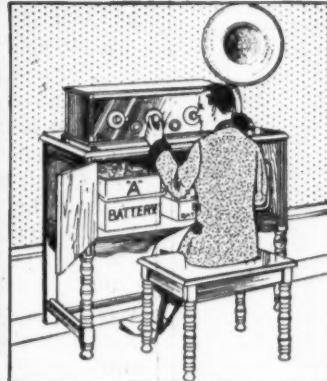
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bench back at our expense and we'll refund your \$1.00 plus all transportation charges you paid. Or keep them and pay only \$1.50 a month till you've paid our smashed cut price for this sale—only \$14.95. Our credit price beats cash prices anywhere. Order by No. B182A. Shpg. wgt. about 70 lbs.

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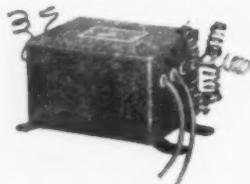
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No. 4586
Low Voltage
Transformer
for UX 226 and
UY 227 tubes.
List \$8.00

For complete electrical operation get Power Transformer (list \$15) and Double Choke (list \$15) for use with A B C 350-400 m. a. rectifier tube. Order from your dealer—or send check or money order to factory direct.

You can replace the A battery and charger with the ideal A C current supply by using the new UX 226 amplifier tubes and the UX 227 detector tube and the Dongan A C Power Transformer.

No. 4586 A C Power Transformer is designed to function also with UX 171 power amplifier tube; No. 4587 with UX 210 power amplifier tube.

Only a few slight changes are required to operate your set with this ideal A C current supply.

HEADQUARTERS FOR POWER UNIT PARTS

Manufacturers of sets and power units have come to regard Dongan as the logical headquarters for parts (transformers and chokes) for the latest approved types of eliminators. For all types of tube and rectifier units Dongan engineers have perfected authorized parts. This close co-operation of the Dongan laboratories with tube manufacturers, plus the advantageous production facilities in the Dongan plant, offers the ideal source of supply.

Set and eliminator manufacturers are invited to make use of these facilities.

Dongan Low Voltage Transformers for the new A C Power Tubes are ready for manufacturers (in mounted or unmounted types).

DONGAN ELECTRIC MFG. CO.
2991-3001 Franklin Street, Detroit, Mich.

TRANSFORMERS OF MERIT for FIFTEEN YEARS

(Continued from page 58)

that's Vignol Battaliana, and I'm here to tell you he's a bad hombre. He has a finger in most of the coast booze supply, only he's hard to get anything on. 'Fraid he'd know me, but I guess he didn't. Good thing, too. He's fast they say, with his gun. Well, we got by them, that's something. There's the Jensen ranch sign now."

The car crested the slope, and started on the down grade. Suddenly the lights went out, and Raule, stopping, stepped out and shook his headlights vigorously.

"Sorry sir, lights are out," he said to Dawson.

"Go ahead on your spot. We're late now," replied Dawson, falling into the spirit of the act.

Raule started ahead again, with his spot focused on the road. Leveling out, the car followed the beach line, and as they took the incline ahead, Raule shifted his gears. "Wet road," he remarked, "and narrow. We could use chains."

Dawson had noted in the faint light of the climbing moon, the sharp drop-off on the beach where a small boat could make a landing. Back of the road lay a heavy mantle of brush extending back a considerable distance, and in which Dawson surmised that the government operatives might be planted.

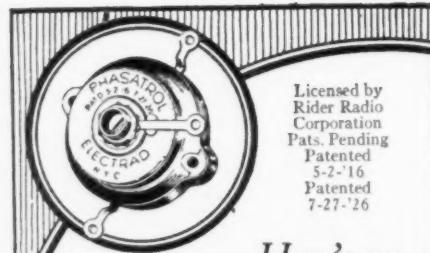
Proceeding slowly in low gear, as they approached the center of the grade, the spot picked up a knarled group of live-oaks and brush. As the car passed under the trees, the side of the car toward the hill above listed sharply, and a figure tumbled into the machine. It straightened up.

"Keep going. I am Smith. Got your signal all right as you came over the hill. Go on about two miles yet. There are a couple of lookouts at the top of this grade, but they won't stop you, as you got by the other side all right. I have a good hiding spot picked out for the car. We will have to cut back around the hill to join the other men. Well, I'm glad you boys have shown up. The chief has had us planted for two days right between the two lookout posts, and we sure have been cramped, keeping out of sight. We're passing the south lookout post now. We ought to have some excitement pretty quick, because we sighted the ship just before dark, and they will be landing before long."

Raule kept on a way farther, and under the direction of Smith, as they reached a lonely spot in the road, drew the car to one side, where a screen of underbrush effectually concealed the car from view. Directly ahead at this point the road doubled in a hairpin curve. From where Raule parked, a clear view of the road in both directions was presented.

Dawson now changed into a more serviceable suit of clothes that he had brought with him, explaining as he did so to Smith that Raule was to remain

(Continued on page 62)



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7-27-26

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Oscillation-
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PHASATROL

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A True Balancing Device for All
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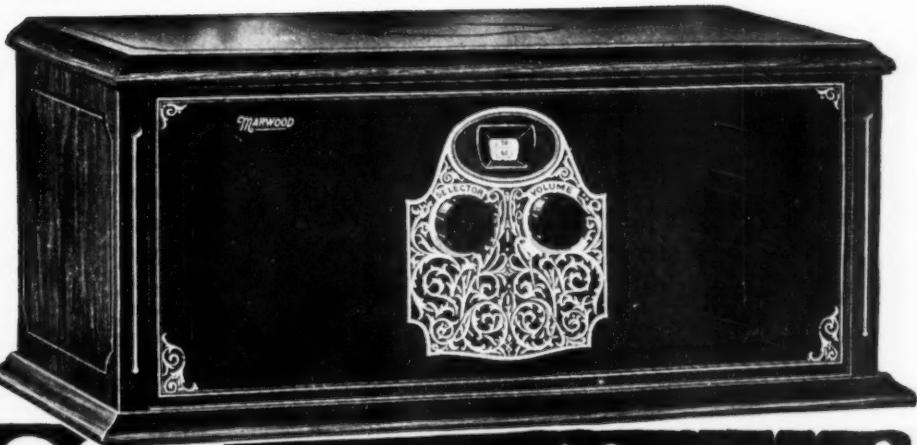
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Guarantee

MARWOOD



The 1928 Sensations! 8 Tube-1 Control

All Electric or Battery Operation

AGAIN Marwood is a year ahead—with the Radio sensation of 1928—at a low price that smashes Radio profiteering. Here's the sensation they're all talking about—the marvelous 8 Tube Single Control Marwood for BATTERY or ALL ELECTRIC operation. Direct from the factory for only \$69.00 retail price—a price far below that of smaller, less powerful Radios. Big discount to Agents from this price. You can't beat this wonderful new Marwood and you can't touch this low price. Why pay more for less quality? To prove that Marwood can't be beat we let you use it on 30 Days Free Trial in your own home. Test it in every way. Compare it with any Radio for tone, quality, volume, distance, selectivity, beauty. If you don't say that it is a wonder, return it to us. We take the risk.

New Exclusive Features

Do you want coast to coast with volume enough to fill a theatre? Do you want amazing distance that only super-power Radios like the Marwood 8 can get? Do you want ultra-selectivity to cut out interference? Then you must test this Marwood on 30 Days Free Trial. An amazing surprise awaits you. A flip of your finger makes it ultra-selective—or broad—just as you want it. Every Marwood is perfectly BALANCED—a real laboratory job. Its simple one drum control gets ALL the stations on the wave band with ease. A beautiful, guaranteed, super-efficient Radio in handsome walnut cabinets and consoles. A radio really worth double our low price.

Buy From Factory - Save $\frac{1}{2}$

Why pay profits to several middlemen? A Marwood in any retail store would cost practically three times our low direct-from-the-factory price. Our policy is highest quality plus small profit and enormous sales. You get the benefit. Marwood is a pioneer, responsible Radio, with a good reputation to guard. We insist on the best—and we charge the least. If you want next year's improvements NOW—you must get a Marwood—the Radio that's a year ahead.

AGENTS

Make Big Spare-Time Money

Get your own Radio at wholesale price. It's easy to get orders for the Marwood from your friends and neighbors. Folks buy quick when they compare Marwood quality and low prices. We want local agents and dealers in each territory to handle the enormous business created by our national advertising. Make \$100 a week or more in spare time demonstrating at home. No experience or capital needed. We show you how. This is the biggest season in Radio history. Everybody wants a Radio. Get in now. Rush coupon for 30 Days Free Trial, beautiful Catalog, Agents' Confidential Prices and Agents' New Plan.

MARWOOD RADIO CORP.

5315 Ravenswood Avenue
Dept. A-1 Chicago, Ill.

Only
\$69 RETAIL
PRICE
Big Discount
to Agents
From This
Price

Get Our Discounts Before You Buy A Radio

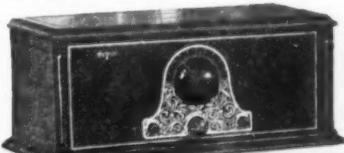
Don't buy any Radio 'till you get our big discounts and catalog. Save half and get a Radio that IS a Radio. Try any Marwood on 30 Days Free Trial at our risk. Tune in coast to coast on loud speaker with enormous volume, clear as a bell. Let your wife and children operate it. Compare it with any Radio regardless of price. If you don't get the surprise of your life, return it. We take the risk. Don't let Marwood low prices lead you to believe Marwood is not the highest quality. We have smashed Radio prices. You save half.

6 Tubes - 1 Control

This is the Marwood 6 Tube, 1 Control for BATTERY or ALL ELECTRIC operation. Gets coast to coast on loud speaker with great volume. Only \$47 retail. Big discounts to Agents. Comes in handsome walnut cabinets and consoles. This low price cannot be equalled by any other high grade 6 tube Radio. Has the volume of any 7 tube set. If you want a 6 tube Radio you can't beat a Marwood and you can't touch our low price.

\$47

Retail Price
Big Discount to
Agents from this
Price.

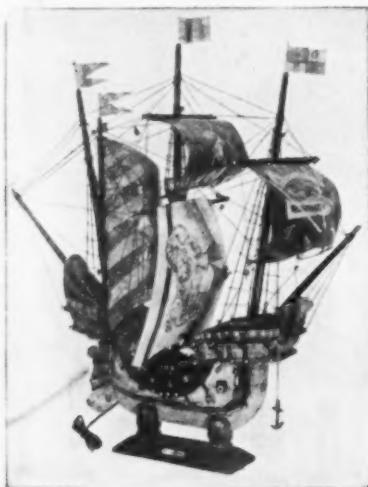


Rush for Free Trial

Marwood Radio Corporation
5315 Ravenswood Ave., Dept. A-1, Chicago, Ill.
Send Agents' Confidential Prices, 30 Days Free
Trial, New Catalog and Agents' New Money
Making Plan. No obligations on my part.
Name.....
Address.....
St. or R.F.D.....
City..... State.....

Tell them that you saw it in RADIO

RADIO'S Greatest Triumph



THE MELODY SHIP

Size: 26" high; 12" wide; 27" long (overall)

You can put these ship model loud speakers together in a few hours of pleasant pastime

You need not know anything about ship building or loud speakers to assemble one of these models. As a matter of fact if you have never seen a ship you can put the ship model loud speaker together in a few hours by following our diagrams and instruction sheet which is so written that a school boy can understand it. All you need is a small hammer. The parts are numbered on the diagram to make the process even more simple. As long as you can understand such instructions as these (actually taken from assembling chart that is included with every model) you cannot fail: "Take No. 57, place it in front end of No. 56 and tap lightly with hammer. Next take No. 58 and place it up against No. 57 and tap with hammer to bring it into place."

Easy? Nothing simpler. The instructions are just like that from the beginning to end. Do this and that—and before you realize it a beautiful model has grown before your eyes.

The MELODY SHIP is made entirely of wood. A positive free edge cone speaker with a unit of the electro magnet type, powerful enough to operate a 72-inch cone, is attached to the main-mast. This insures splendid service and ample volume with no distortion.

The loud speaker is made in the shape of a sail and does not alter or change the appearance of the ship in any way. The sails are artistically painted with the various designs and figures of the period represented by the models.

The tone of this loud speaker is far superior to any cone of its size on the market today. This is made possible by our patented melody sail.

Write for our beautiful illustrated catalog. Fill in the coupon below and we will act upon it immediately.

MINIATURE SHIP MODELS, Inc.
3818-20-22-24 Baring St.

Philadelphia, Pa.

Canadian Branch:
1485 Bleury Street, Montreal, Canada

MINIATURE SHIP MODELS, Inc., Dept. Y
3818-20-22-24 Baring St., Phila., Pa.
Please send me the complete parts, for the
loud speaker ship model cut to fit, and
ready to assemble for the La Pinta as
shown above. I will pay postman \$12.50
plus postage (a few cents).

PLEASE PRINT NAME AND ADDRESS
PLAINLY

Name _____

Street or R. F. D. _____

City _____

State _____

(Continued from page 60)
with the car, and telling briefly of the reason of his assignment to the job. Smith listened closely to that part concerning Lefty Blackburn. Then Dawson and Smith moved off into the night, while Raule planting himself in the back seat, set up the superheterodyne, and prepared to kill time with whatever broadcast program he might find agreeable.

Finally he dozed off, only to come alertly awake as he heard the grind of gears as a car came from the south. It was now around eleven o'clock. So far, there had been no northbound traffic, although two southbound cars had gone through earlier in the evening. He withdrew one of the phones as he twirled the dials for a late working station. The car coming toward him turned the hairpin curve slowly, and came to a coughing stop in front of his protective screen of brush. The driver made several ineffectual attempts to start the motor, and then cursing, climbed out and raised the hood. Inside the roadster, another figure cursed the driver. He looked up from where he stood.

"Listen, Blackburn, cut that. I can't help it if the motor is bucking. We've had one cylinder out ever since we left. Besides, don't yelp so loud. I've found part of the trouble—carburetor screen is clogged, for one thing, but that doesn't explain the missing cylinder." He dropped the hood down, climbed back in the car, and it moved onward.

Raule, who had removed both phones to hear what was going on, came up with a jerk at the mention of Blackburn. His blood tingled in an instinctive reaction. Then he laughed at himself. Just a coincidence. Still, it might be Lefty Blackburn himself, but what was he doing here heading from the south, and by automobile. Should he attempt to reach Dawson—but he dismissed the thought. Even if he could reach Dawson, it would be too late to stop the car and investigate, and he could hear the razzing Dawson would give him, with a grinning bunch of pros listening in—that is, providing he found Dawson without getting shot in the attempt, between the rum runners and the operatives, to say nothing of spilling the beans in the coming attempt to capture the contraband cargo and the crew of the ship. He shrugged his shoulders, and set the phones on his ears.

Some ten minutes or so had passed when Raule was again aroused, this time by a succession of shots and yells, dim and muffled by distance, but nevertheless unmistakable. Raule tried to visualize the situation, picturing himself at the head of the attacking operatives, leading them on against odds, and in general distinguishing himself. Then he laughed, having a keen sense of humor, and once more turned his attention to

(Continued on page 64)

Listed by
Underwriters'
Laboratories



ELECTRAD

Lamp Socket Antenna

\$1.00

Aerial wires around mouldings or on the roof are not pretty. Do away with them—use this Lamp Socket Antenna which makes every outlet an aerial.

Efficient—gets distance. Consumes no current, neat in design and SAFE. Tested at 2500 volts A. C.

At your dealer's or write

Dept. 57, 175 Varick St., New York

ELECTRAD



The Latest and Best in Socket Design

The Eby Socket is completely NEW throughout. Its design is in strict accordance with the latest developments in socket manufacture and radio reception.

The New Eby Socket has a 3 point wiping spring contact the full length of the prong—the most scientifically perfect type known. The contact prongs can't spread.

Easy to mount above or below Bakelite, Wood or Metal. List Price 40c.

The H. H. EBY Mfg. Co., Inc.
4710 Stenton Ave.
PHILADELPHIA, PA.

At the first crack
of the World's Series
bat....

"You're there with a Crosley!"

THE CROSLEY RADIO CORP.
Can you explain "balancing," so folks
can understand it? We technical people
know that Hazeltine's neutrodyne
principle is a wonderful thing. If you
can make it understandable to lay
men you're good. Yours truly,
The Electric Corporation.
Los Angeles, Cal.

Nature always puts obstacles in our way. When men begin to study a new invention or discovery they find that there are many problems to solve before a successful device can be built. This was the case with the steam engine, the printing press, the automobile, the aeroplane, and every other major invention that you can think of.

The vacuum tube is, perhaps, one of the most remarkable inventions ever made. We found that we could use it to amplify the radio signals. But when we tried to tune these amplifiers, so that they would help us select the desired signal, we found that the vacuum had a tendency to misbehave.

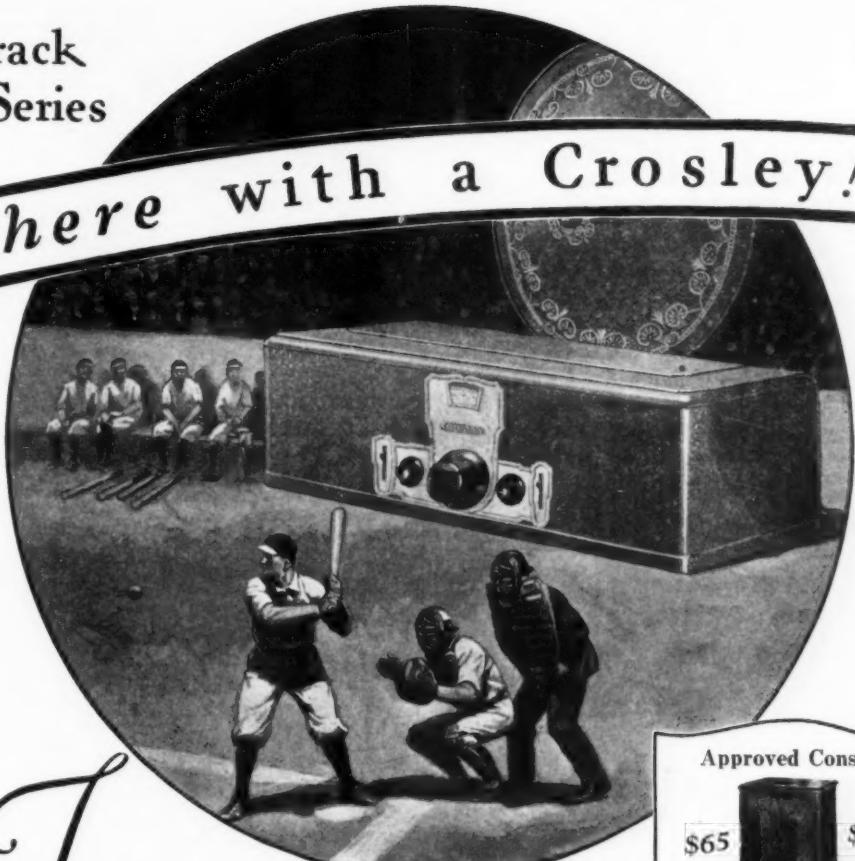
When a tube is used to amplify, the output voltage is much stronger than the input voltage. This is the natural result of the amplification. But there is a path back through the tube through which some of the strong output voltage can get back to the input side of the tube. This voltage is then again amplified and again turns, getting stronger each time, the result being that the tube goes wild. It becomes a miniature broadcasting station on its own hook.

If we can provide a second path from the output circuit to the input circuit, so arranged that the voltage which comes back through this second path is opposed to the voltage that comes back through the tube itself, we can prevent the trouble. This is called "balancing."

Amplified signals returning to tube mixing it up with incoming signals because the second path is adjusted so that it exactly balances the path through the tube.

Hazeltine divides Bolshevik voltages. Balancing each other by opposing each other they cause no rumpus in the tube and program signals go thru amplifier without interference

The Hazeltine method of balancing (or neutralizing) this path through the tube has several unique advantages over all the other methods that have been proposed. This is why Crosley radios use the Hazeltine "neutrodyne" method.



*THIS new Crosley Bandbox
6 TUBE RECEIVER de luxe
is the national radio hit at \$55.*

Its amazing performance is the result of its remarkable construction—the introduction of features found in the most expensive of radios and possibly at \$55 only thru mass production methods, plus the licensing of Crosley for use of the patents, research resources and discoveries of The Radio Corporation of America, The General Electric Co., The Westinghouse Co., The American Telephone & Telegraph Co., and The Hazeltine and Latour Corporations. Check any radio at any price against these Crosley features—standards of comparison that indicate the Bandbox's superiority.

- 1—Completely shielded coils, condensers and wiring.
- 2—Acumulators for sharpest tuning.
- 3—Completely balanced genuine Neutrodyne.
- 4—Volume Control.
- 5—Single tuning knob.
- 6—Illuminated dial.
- 7—Single cable to outside connections.
- 8—Designed for easy installation in consoles.
- 9—Beautiful frosted brown crystalline finish.

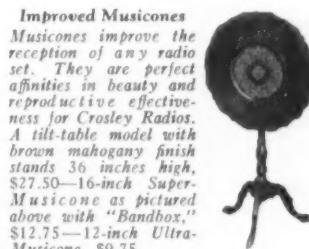
AC model using new R. C. A. AC tubes and working directly from electric light socket through Crosley Power Converter \$65. Power Converter \$60.

The value of this Bandbox receiver and the excellence of its performance can best be judged by seeing it and hearing it at the nearest Crosley dealers. If you cannot locate one of the 16,000 dealers, write Dept. 19 for his name and address and Crosley literature.

Approved Consoles

 \$65	 \$85
 \$35	

Selected by Powel Crosley, Jr., as ideal, acoustically and mechanically for the installation of the Crosley "Bandbox." Genuine Musicone built in. Crosley dealers secure them from their jobbers through H. T. ROBERTS CO.
1340 S. Michigan Ave., Chicago, Ill.
Sales Agents for Approved Console Factories
Showers Brothers Company
The Wolf Mig. Industries



Improved Musicones
Musicones improve the reception of any radio set. They are perfect affinities in beauty and reproductive effectiveness for Crosley Radios. A tilt-table model with brown mahogany finish stands 36 inches high, \$27.50—16-inch Super-Musicone as pictured above with "Bandbox," \$12.75—12-inch Ultra-Musicone, \$9.75.

GROSLEYRADIO

THE CROSLEY RADIO CORPORATION
Powel Crosley, Jr., President Cincinnati, Ohio
Prices slightly higher west of the Rocky Mts.



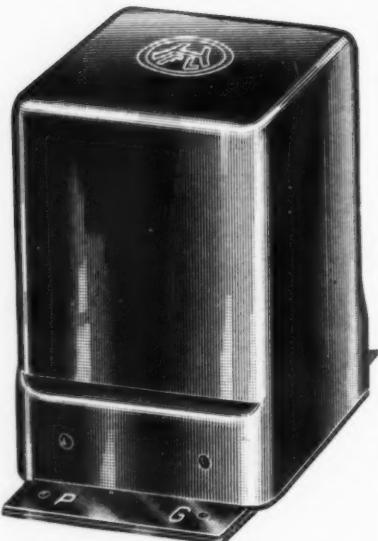
Crosley is licensed only for Radio Amateur, Experimental and Broadcast Reception.



Transformers

Two Additions to Last Year's Radio Sensation. The Amazing Achievement in Audio Amplifications

Designed for set builders who demand efficiency, sensitivity, precision and high quality



H. F. L. C-16 Audio Transformers and C-25 Output Transformer—New companions of a Great Unit, will work in any circuit and improve any radio set.

H. F. L. Units Give Wonderful Clear Reception

Engineers acclaim H. F. L. C-16 a marvellously efficient Audio Transformer. It carries signals at highest volume and lowest amplitude without blasting or developing harmonies. Operates with all power tubes as well as standard tubes.

H. F. L. C-25 Output Transformer handles the voltage output of power amplifying tubes, at the same time matches the impedance of the average speaker to tubes. Protects loud speaker unit without reducing plate voltage.

Mechanical features of these two transformers are: A coil designed and treated to exclude moisture and withstand heavy electrical surges without breaking down—complete magnetic shielding to avoid interstage coupling—terminals brought out so as to insure short leads.

PRICES

No. H-210 Transformers	\$8.00
No. H-215 Transformer	8.00
No. C-25 Output Transformer	8.00
No. L-425 R. F. Choke	5.50
No. L-430 R. F. Transformer	5.50
No. C-16 Transformer	8.00

Set Builders—Dealers

If your jobber cannot supply you with H. F. L. Transformers, wire us for name of nearest jobber.

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EASY to sell American Radios and Supplies. Nationally advertised, high quality merchandise at wholesale. Big profit on every sale. No capital to invest. No stock to carry. Order direct. Get My Liberal Offer and the Big New 132-page Catalog and Guide—“How to Sell Radios”—Free. Full of Bargains—all latest in Radio. Write today. AMERICAN AUTO & RADIO MFG. CO. HARVEY SCHWARTZBERG, Pres. Dept. 14. American Radio Bldg., Kansas City, Mo.

METERS

WE REPAIR THEM
REGARDLESS OF MAKE

VOLTMETERS AMMETERS WATTMETERS

Send Them To Our Laboratory



219-221-223 NATOMA STREET
SAN FRANCISCO

Tell them that you saw it in RADIO

(Continued from page 62)
his dials. In a few moments he again became suddenly alert, and, jerking the receivers from his ears, whipped a pistol from his pocket and jumped from the car.

IT WAS a weary and disgusted sleuth in the person of Dawson some two hours later who found his way back to the car. Raule was sitting on the running board awaiting him. “Get your man?” queried Raule pleasantly, as Dawson came up.

“Naw,” said Dawson with more force than elegance. “They got the rest of the bunch alright, and all tied up tight—that is they got the first boatload that came ashore, but Blackburn wasn’t with them, and when the shooting started, which we didn’t figure on so early, the ship put out to sea. The guys we got won’t talk and if they would it wouldn’t make any difference anyway, because Blackburn isn’t with them,” and Dawson dejectedly sat down on the running board of the car beside Raule, and filled his pipe with Teamster’s Delight.

“Well, that’s too bad,” sympathized Raule. “But say, take a look in the back of the car and see what I’ve got, will you?” Perplexed, Dawson opened the door and peered in. Trussed up on the seat of the car, a neatly tied figure glared back at him, at first defiantly, then with a growing expression of fear in the narrow eyes.

“Well, I’ll be sunk,” gasped Dawson. “Lefty Blackburn, by Christmas.” Then bereft of speech, he turned to Raule for an explanation.

“It’s not a very long story,” said Raule, “and I can tell it to you after we get under way. You might take a look at the way Blackburn is tied up. It’s hard to tie a fellow when you have to hold a gun in one hand and work with the other, and this boy sure told me plenty while I was fastening him.”

With the prisoner securely trussed, Raule piloted the car back to where the government operatives had assembled on the beach with their prizes. One of the men had started a fire over which a pot was boiling, while others were fishing out of the surf the last cases of liquor that had gone overboard when the small landing boat had upset in the surprise attack. They surrounded Raule and Dawson and at sight of the manacled Blackburn shot questions at both the men.

“He’ll have to tell you the story,” said Dawson, pointing to Raule. “I don’t know how he done it, but he sure got the bird I wanted.”

Briefly as possible, while he drank a cup of coffee handed to him by one of the operatives, Raule told his story. “The whole think happened so quickly,” he said, after telling of setting up his superheterodyne, and of the stalling of the car in front of his own machine, “that when I heard the other fellow call Blackburn by name I couldn’t think

fast enough to handle the situation. Then, I had no proof, and didn't know Blackburn well enough to recognize him. So I did nothing. But when I heard the shooting, and heard his car coming back, I decided that he might be the man wanted, just why would be hard to say, so I took him by surprise and here he is."

"But how did you know that it was his car coming back?" came in chorus from Dawson and others simultaneously, while even Blackburn showed faint curiosity.

"Ah," replied Raule, reaching for another cup of coffee, "that is where the gentleman of ebony hue takes his place in the fuel supply—or to put it plainer, where the superheterodyne comes in. Now listen, so that you will all get this fully!"

"When the car stopped opposite of me, I still had one receiver over my ear. Now, you know that an automobile motor is operated by the explosion of gas in the cylinders, induced by an electric spark between the terminals of a spark plug. You get me?" he queried, whereat the closely assembled group nodded. "All right! Now, these plugs, with their electrical discharge, are miniature transmitting stations, capable of sending out an electrical radiation for a short distance, depending upon the ignition system used, and the sensitivity of the receiving set. Under certain conditions, a sensitive receiving set will pick up these discharges several hundred feet away, registering in a steady rhythmic series of clicks, depending upon the speed of the motor. For instance, if the superheterodyne were in the car itself, the discharges of the ignition system would be sufficient to render the set temporarily inoperative, due to the strength of discharge.

"I noted the firing of the motor when the car first stopped in front of me, its rhythm broken somewhat regularly, as though there was a fault in the ignition, a defective cable, possibly. Of course I knew this for a fact when I heard the other guy tell Blackburn that one cylinder had been missing for some time.

"From what Blackburn told me after I got him tied up, although he refused to admit that he was the Blackburn that Dawson wanted, he and the driver got to the beach just when you fellows started shooting. The driver jumped out and ran ahead to find out the trouble. Blackburn, shot with dope, and fear crazed, turned the car around and started back. I picked up the irregular firing of the motor while the car was some three hundred feet or so away, and, knowing that it was the same car that had passed before, decided to stop it. I shot the rear tire out as Blackburn passed. He couldn't see the flash of the gun, and thought that the report was the tire. He stopped on the hair pin

Vee Dee Metal Cabinet for Latest Hook-Ups



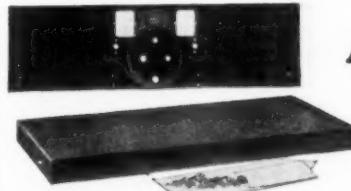
Model 250

For A. C. or Battery Sets using panels size 7x18, 7x21, 8x18, 8x21

Inside dimensions 25" x 14 1/4" x 9 1/4". Hinged top with stay joint. Rigidly formed for strength and appearance. Felt foot rests—rubber lid stops. A welded job doing away with troubles of swelling, shrinking, cracking, splitting and the uncertain fit of wood cabinets.

The original beauty of natural wood grains combined with the efficiency of all metal construction! By our photo litho process, we reproduce mahogany and walnut hardwood, and novelty finishes, so gorgeous in their conception that they excite the admiration of all.

Spacious interior dimensions are demanded for housing all the latest hook-ups! Vee Dee metal cabinets are designed for that purpose. 90% of all the 1927-1928 hook-ups are covered by the dimensions of Vee Dee No. 250 cabinet. Beautiful—practical! Low price!



Metal Panel and Chassis for Silver-Marshall 1927 Improved Laboratory Model Super - Heterodyne

Complete assembly consisting of panel and chassis, fully drilled, beautiful wood finish with special two-color decoration, all fibre bushings and washers included, also screws, bolts and hardware accessories.

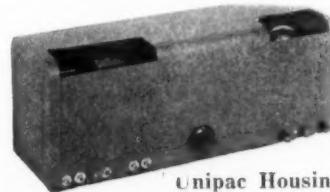
Vee Dee Assembly Units

Complete with bushings, washers and all necessary hardware.



S. C. 2 Assembly Unit (Silver - Cockaday)

Designed and drilled for this popular receiver, but dimensions are such as to make it easily adapted for any Power Pack assembly.



Unipac Housing

Especially designed and provided for Silver-Marshall Power Hook-ups—including cabinet and chassis, drilled and with all small hardware.



Metal Panel for Citizens Super Eight
Constructed in accordance with Citizens Radio Call Book and McMurdo Silver, Remler, Cockaday co-ordinated designing.

METAL PANELS AND CHASSIS IN ALL STANDARD SIZES
JOBBERS, DEALERS—Write for prices. SET BUILDERS—If your dealer cannot supply, write direct.

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FAST CONDENSERS FOR ABC PACKS

Fast Hi-Test, extra capacity condensers are built to withstand every requirement of usage. Millions now in use and since 1919, one of the oldest established and reliable manufacturers.

An exclusive feature—by-pass condensers enclosed in one-piece die-press steel housing, makes them positively impervious to climatic conditions or abuse. Before being encased condensers receive special laboratory treatment, moisture content is effectively removed and the housing seals them permanently—Fast condensers thus give better service.

Illustration shows condenser pack used in Q. R. S. or Raytheon A-B-C unit. Fast condensers fit all units, whether specified or not. Write for free condenser booklet. Dealers and jobbers, send for prices.

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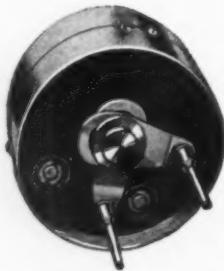
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Send for it today
Dealers, set builders—make this your biggest radio season. Shure's great wholesale catalog insures the best in quality at lowest prices. This wonderful book is jammed full of the newest models of radio sets, accessories, table and console cabinets, etc. Also contains short wave section showing the finest electrical apparatus for short wave receiving and transmitting. Your request on letterhead brings our book of a thousand bargain price list and discount sheet. Write for a copy today.

2000 Items Big Values

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RADIOLA,
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YOU can conserve the useful life of your tubes and batteries and improve the reception of your set by always operating at the exact filament voltage for which the set was designed.

If you own a Radiola 20, 25 or 28, Victor or Brunswick Set, this Pin-Jack Voltmeter is indispensable for the best reception.

Because of the high internal resistance of this instrument (125 ohms per volt) it can be plugged in on the panel permanently without wasteful effect on the batteries.

This handsome little meter adds charm to and blends with any cabinet, because of its artistic case finished in green gold, and its black scale with gold markings and pointer. Very simple to use. Just plug it into the filament voltage jacks—turn the instrument around until it reads in an upright position—then turn the control rheostat until the pointer reaches the red mark on the dial—*There* you will be operating for both economy and the best reception.

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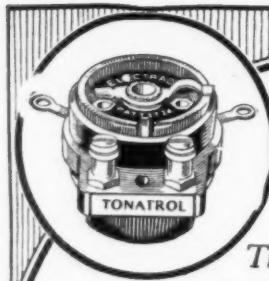
curve and I stepped out and covered him. His car is back there yet, by the way—one of you boys had better go back for it."

Amid the remarks of the closely listening group, Raule went on. "You may wonder that the ignition system would carry several hundred feet, considering that it is very highly damped—if that means anything to you," he added smiling, "and I was surprised myself until I figured it out this way. The road along there is still wet and muddy from the rains, and undoubtedly the wire wheels of the car and the wet tires made a partial ground, which, combined with the ignition cables leading to the plugs, formed a radiating system of sorts. Then also, I had grounded the loop on the set, which would, under the circumstances, make the pickup possible over a greater distance than otherwise. If I hadn't heard the misfire of the cylinder in the headset, I would hardly have attempted to stop the car, as it would have been too long a chance."

Blackburn's presence in the car at that point, rather than on the rum runner, was explained later in his confession at headquarters. The rum runner, beating up and down the coast at this point, had landed Blackburn, chafing at his prolonged stay in cramped quarters at sea, at a point where he had made his way into Santa Cruz, where a trusted friend had undertaken to drive him north. Blocked from the main highway, by reason of road repair, they had chosen the coast road. Blackburn had not told his friend about the plan of the rum runner to land her contraband—in fact it was doubtful whether Blackburn himself knew of the particular landing place. The stumbling of Blackburn into the hornet's nest was purely coincidental—one of those things that just happen.

The episode served to establish Raule firmly on the force as a made man, Dawson not failing to give credit generously in his story at headquarters. Not that they gave the correspondence course any credit for it, however. Dawson maintained that Raule succeeded, not because of the course, but in spite of it. While Raule, remembering Lesson Number Seven, The Successful Detective in Ten Lessons, sawed wood, the while mentally giving radio its due for the second time in his short career as a detective.

LATEST LOG BOOK **25¢**
ALL THE NEW LISTINGS
HANDY POCKET SIZE
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Licensed by
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1593658,
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*The Perfected
Volume Control*

TONATROL

A True Tone and Volume
Control

Your neighbors will envy the ease and convenience with which you secure every gradation of volume if you use "Tonatrol."

This new tone and volume control enables you to change from soft music, clear and sweet, to powerful house-filling volume a second after. A helpful addition to any receiver. Constructed to last with genuine bakelite. Very simple to install.

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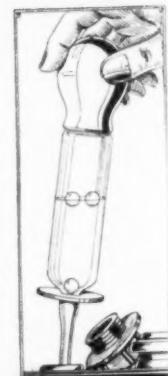
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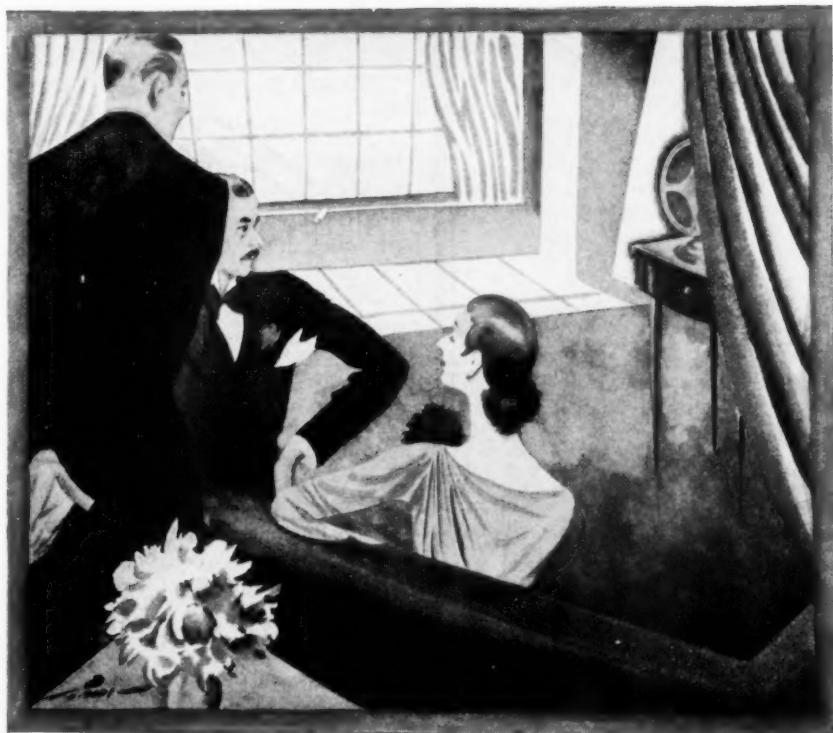


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EXPERIMENTAL SHOP PRACTICE

(Continued from Page 36)

Any wood will do damaskeening, but a fairly firm material is to be preferred. Birch is excellent. The charging with tripoli is done by pressing up the block of tripoli against the lower end of the revolving stick. Charging with powdered emery or carborundum is done by putting a little of the powder on a piece of metal and pressing that up against the stick.

Just as tools of carbon steel are brought to the right hardness by first making them glass hard and then drawing the temper by gentle heating, so carbon steel articles can be beautified by drawing the temper to a desired color. The range of possible shades is about as follows, though of course the colors succeed each other in imperceptible graduations and not by steps as given in the list: Very pale yellow, straw yellow, dark yellow, brown yellow, spotted red-brown, light purple, dark purple, full blue and dark blue.

It must be clearly appreciated that these successive colors correspond to successive grades of hardness of the steel that is being colored. For example, the "very pale yellow" shade gives a hardness fit for taps and dies, and is nearly as hard as steel can be used for any tool at all; on the other hand, the "dark blue" shade is that fit for wood screws, where the only call for strength is at the slot where there is a good deal of metal, and that shade corresponds to an almost complete softness. Therefore, for these reasons, one must never color a piece of carbon steel to a color lower in the list than that required as a stopping-point for the required hardness, whatever his artistic desires may be as to the color for ornamental reasons.

One of the best and most striking of the colors in the foregoing list is that of "spotted red-brown." It can be used with good effect on small tools which the amateur makes for his own use, and adds greatly to their charm. But before giving the mottled finish which is provided by that degree of heat, every vestige of tool marks and scratches must be removed.

This is easily done by a proper succession of abrasive materials, for after all the secret of eradicating scratches from metal surfaces consists merely of adding a succession of finer and still finer ones. That is, to finish a steel surface fully bright, rub it with emery cloth or carborundum cloth, then with each of two or three finer grades of such cloth, and finally with crocus cloth. One minute or two of rubbing is required with each grade, if the piece of steel be small. If the piece is cylindrical, shine it in the lathe by spinning it while a strip of cloth is held around it and pulled by both hands.

For flat and irregularly shaped pieces that cannot be polished in the lathe, there is a great convenience in the use of what are called "emery sticks," though they are not always coated with emery. These are narrow strips of wood covered with carborundum paper or crocus paper, not cloth. They are used like files, and their success surprises one at the first time of using.

DIRECT COMMUNICATION

(Continued from Page 38)

THE KVL docked at Charleston two hours late and our operator, dolled up in shore clothes, with a palm beach suit, panama hat and typical jaunty air was about to leave the ship for a stroll ashore.

"Captain wants to see you, Sparks," announced the quartermaster at the plank. "Said for you to come right away."

The "naughty naughty" operator knocked timidly at the captain's cabin door and a gruff, very gruff voice, commanded his entrance. He opened the door but to fall back a pace. In the room, seated in a semi-circle sat the stern old skipper, his senior wireless operator, the chief mate and a steamship company official and—horror of horrors, Mrs. Henry Thornagle Vandusen, looking as pompous and important as an old hen that's just laid an egg.

"Young man, what have you to say for yourself?" demanded the stern old skipper with an angry light in his piercing eyes.

"N-n-nothing, Sir." In a very small voice.

"Did you deliberately lie to this lady? Speak up! Did you, did you?"

"Yes-s-s, Sir," still weaker voice.

"Well, you leave this ship at once, you lying whelp. Pack your things and get off right away. I'll see to the relief operator."

At this point the "special" passenger, looking very satisfied, left the room accompanied by the company official who attended her with a great effect at gallantry. But as he stepped from the door and glanced back over his shoulder, one could detect a most imperceptible wink in his eye, directed towards the remaining group.

"Sparks," spoke the aged skipper, rising and advancing on our woebegone operator with a menacing scowl, "You certainly put your foot in it this time. Lucky if you don't lose your ticket. Why man, I never heard of such a foolish thing." (By this time the "special passenger" was far down the deck out of earshot). "But," continued the skipper, with a new light flickering in his eyes, "If you ever do that again you're fired. Now, get out and behave yourself after this."

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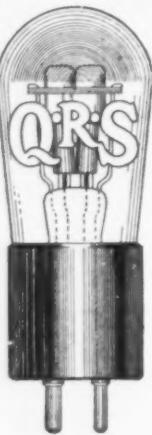
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R.F. TRANSFORMERS

(Continued from Page 41)

of a 201-A tube together with the Aero Universal Coil. For loss neutralized systems, a coupling value M equal to 10 microhenries is recommended as most satisfactory. However, in some cases where extreme selectivity is desired and some amplification can be sacrificed, an M of 6.6 microhenries may be used. For neutralized circuits, an M of 18 microhenries should be used and neutralization may be accomplished in the manner shown in Fig. 10. It is interesting to observe in connection with Fig. 9, the manner in which the selectivity decreases as the amplification increases.

The performance to be expected with the 199 type tube is shown in Fig. 11. It will be noted that with M equal to 6.6, the amplification is extremely low. For that reason no selectivity curve is shown as this combination of tube and coupling is unsatisfactory. The value of M equals 10, will be found useful in loss stabilized amplifiers, while the

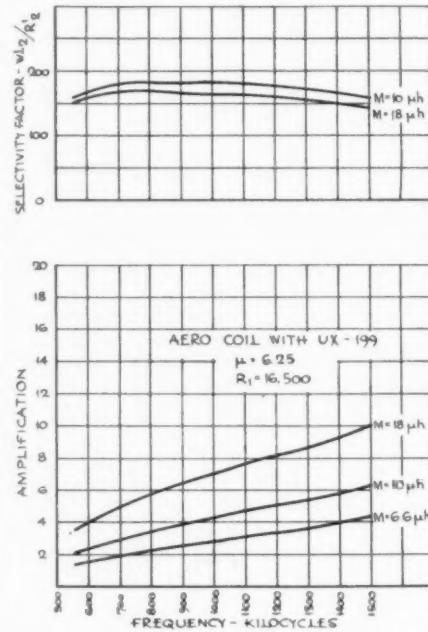


Fig. 11. Performance of Coil With 199 Tube.

value M equals 18, may be used in either loss stabilized amplifiers or neutralized as per Fig. 10 with somewhat less amplification than the corresponding connections for the 201-A tube. This is due to the fact, that the 199 has a lower amplification constant and a higher plate resistance than the 201-A tube.

In Fig. 12, are shown 3 connections for operation of the Universal Coil with the UX-112 type tube, operated at 90 volts plate potential. These curves are very similar in character to the curves given for the 201-A type tube except in the case of an M of 18 microhenries where the amplification is very much higher, although the selectivity is rather low. The use of this combination would be valuable in any tuned radio frequency type of receiver where the lo-

cation permits considerable sacrifices in selectivity or for radio frequency stages

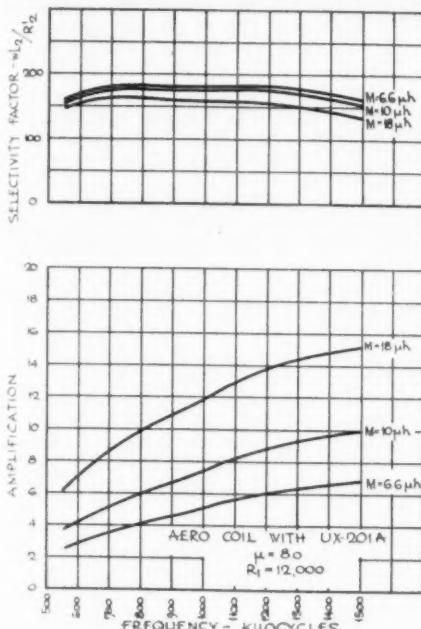


Fig. 12. Performance of Coil With UX-112 Tube.

preceding a superhetrodyne where selectivity in those stages is now paramount.

In Fig. 13, curves are shown on the performance of the Universal Coil with the new Hi-Mu, high impedance 240 tube operated at 90 volts plate potential. It will be noted that the amplification for this connection is very high,

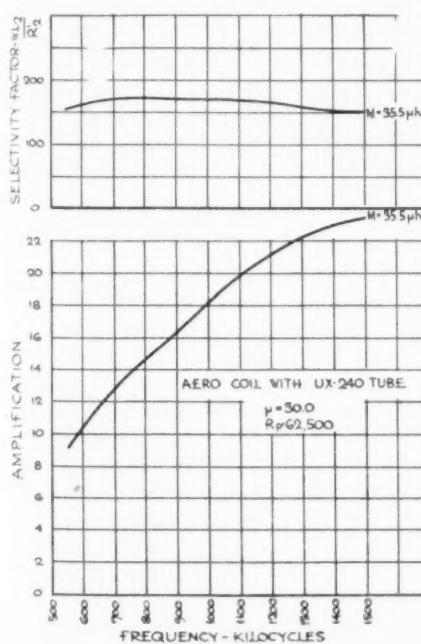


Fig. 13. Performance of Coil With UX-240 Tube.

while the selectivity is not greatly impaired by the large value of coupling. This tube as a radio amplifier, is being used very successfully in the design of a receiver for the 1927-28 season.

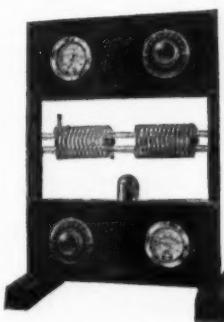
It should be noted that curves of this nature are accurate, only in neutralized or bridge type radio frequency circuits.

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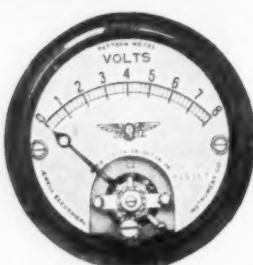
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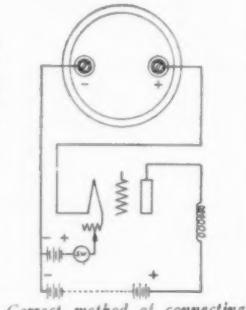
The instrument is easy to mount and is connected as shown in the diagram.

Write for descriptive form No. 776.

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Pattern No. 135
Filament Voltmeter



Correct method of connecting meter for filament control.

QUERIES AND REPLIES

(Continued from Page 42)

either the detector or first audio stage; if shorting the secondary of the first audio transformer cures the trouble, you can be practically certain that it is coupling in the B or C battery leads. Extra bypass condensers of 1 mfd. or more placed across the B battery supply to the audio stages will sometimes stop this sort of trouble, and another cure is to shunt the secondaries of both audio transformers with $\frac{1}{2}$ megohm grid leaks. Make sure that the metal cases of the transformers are connected to the negative A battery, and then grounded.

In the June issue of RADIO, data on the subject of iron core chokes of 10 henrys each were presented, for use in an "ABC" eliminator. I wish to build a 30 henry choke, and would like to know how many more turns of wire I will need, on the same size core. The choke is to be used for "B" voltage only, so that the current flow through the coil will not be more than 50 milliamperes.—E. H., Alameda, Calif.

With the current drain limited to 50 milliamperes, you can use smaller wire, and thus get many more turns on the same size core. Wind 15,000 turns of No. 34 or 36 cotton covered or enameled wire on the core presented in June RADIO, and reduce the size of the air gap to about half its present width.

PHONOGRAPH PICKUP

(Continued from Page 37)

and the unit fastened thereto. The phone cord is fastened to the wires from the magnet, and the unit assembled finally screwing the cap on the receiver case.

It is now ready for a trial run. Fasten it to the arm of the phonograph, and without attaching it to the set, let it run over the record. If a rattling is noticed, thoroughly tighten all the parts and place small pieces of rubber between both sides of the armature and the magnets, striving to get it to run as silently as possible.

After it is working to your satisfaction, connect the free ends of the cord to the plate and filament terminals of a tube socket. This socket is now inserted in the detector socket of the receiver, and when the reproducer is placed on the record it will reproduce the music from the record.

If the record scratching becomes objectionable, a filter may be constructed from an inductance of 200 mfh. and a condenser of .008 mfd. connected as in the wiring diagram. This filter should have a slight amount of iron in the inductance core in order to broaden the bypassed wave band slightly. A honeycomb coil of 1500 turns is about right for the inductance. This arrangement is tuned to about 5500 cycles and the greater part of the scratch noise is removed without seriously affecting the quality of the music.

Volume control can be obtained by a variable high resistance of the Centrolab or Clarostat type or from the volume control on the set if it is in the audio channels.

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WAVEMETER CALIBRATION

(Continued from Page 45)

The bracing blocks for panel and condenser support are $\frac{1}{8}$ in. square wood. The coupling coil is 4 in. in diameter of No. 12 wire.

The wavemeter should be placed at a convenient distance from the oscillator consistent with a good plate meter "flick," and as soon as the wave is measured the scale setting should be noted. A grid meter could be used if handy. Do not measure the distance from the shorted-end of the wires to the first node as this is often very much less than one-half wavelength due to the loading-effect at the shorted end. Poor agreement between amateur 5-meter wavemeters is often due to this error. Wait about 5 minutes after the plate voltage has been applied so that the frequency has become constant, for accurate results.

To spot a point on the wavemeter, couple the oscillator inductance to the shorted end of the wires and move the bridge along them. (4 or 5 turns of No. 14 wire, about 2 or 3 in. in diameter and spacewound should be about the correct inductance to start with). Watch the milliammeter in the oscillator plate circuit and for certain positions of the bridge the plate current will show an abrupt increase. Note the distance between two such positions, this will correspond to one-half wavelength. Take a stiff piece of copper wire and solder it to the condenser terminals of the wavemeter so as to form about a 4 inch loop. Bring the wavemeter up to the oscillator and tune it until the oscillator shows the same increased plate current (usually very sharp resonance). This will give a general idea where this particular wavelength tunes in on the meter and a little experimentation with coil sizes will give the desired settings. It may be necessary to remove the bridge from the wires while this is being done.

Very close coupling between the oscillator and wires may give two wavelengths on them, so loose coupling should be used. A UX-210 will oscillate at 2 meters with little difficulty; shorter wavelengths cause increased difficulty.

The method is simpler than those ordinarily used. No extra indicators are necessary. It is to be noted that it is unnecessary to tune the wires into resonance, with the oscillator (this procedure often being difficult). However, in order to obtain strong indications it is desirable to adjust the plate and grid series condensers so the oscillator is unstable. These condensers, when beyond a certain capacity, cause the plate current to fall to a very low minimum which is a suitable indication of oscillations. Reduce the capacity of these condensers until the plate current increases; about midway between minimum and maximum plate current, which is obtained when oscillations cease, is about right. The bridge should be a piece of bakelite, serving as a handle, to which is bolted a thin piece of sheet brass somewhat longer than the distance between wires. It is otherwise as shown in Fig. 2.

The settings of the instrument may be transferred to any other instrument containing an indicator by means of an oscillator or receiver. A small error due to a different velocity of the waves on the wires as compared to in the ether, need not be allowed for in ordinary work.

After a wavemeter is calibrated covering the 5-meter band, one can construct a receiver covering this range; and if the oscillator is then operated at $2\frac{1}{2}$ meters, the wavelength can be checked by listening for harmonics, also. With the oscillator shown, the lower limit is approximately 1.4 meters and for wavelengths in this vicinity, one of the condensers is disconnected and the other is connected directly across the plate and grid. Practically, with about 1 in. of wire external to the tube and a small air condenser, 1.4 meters is about the lower limit of a CX-310.

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NORTH PACIFIC SCHEDULES

(Continued from Page 47)

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KPH, NPL, 2UO, WUT, NAA, VAE and WNU press can be easily copied at any time east of the 180th Meridian. Under good conditions they can all be copied as far west as Japan and Guam.

WNU's schedule at 1630 GMT can be copied as far north as Seattle on the Pacific coast but not very far to the westward. The 0430 GCT schedule can be copied as in the paragraph above.

Of these seven schedules, those of KPH, 2UO and WNU are the best for real "live" news. VAE press is much like that of KPH. NPL press is inclined to be of a naval or government character with the general news items of a more or less "colorless" nature. VAE and NPL send each word twice. 2UO press, New York City items, WUT, general news and Pacific Northwest and general good.

GBR and JAA can be easily copied anywhere in the Pacific but the press from both stations is of an official nature, mostly uninteresting.

NPO press is similar to that of NPL with a few additional Philippine or Oriental items. It can be copied anywhere in the western Pacific but it is "machine sent" and often so badly hashed as to be unreadable.

The press sent on the NPM traffic schedules consists of Associated Press or United Press messages to newspapers in Manila. The press files come through at intervals with other traffic. The 11490 and 37 meter waves of NPM can be copied anywhere in the Pacific but there is always some uncertainty as to just when the press will start and it is necessary to keep a more or less close watch on the station over a period of many hours.

WRQ can be copied to the eastward of the 180th Meridian and NSS can sometimes be copied when KET, KIE and KGI are not going. NSS press is sent simultaneously by NAA on 37.4 meters. Copied easily anywhere east of 180th Meridian.

Ship Weather Reports

Weather reports from vessels in the N. E. Pacific are sent as a part of NPG's Major Weather Bulletins.

Japanese ships in range of their coast stations, send in reports at 6 AM, Noon and 6 PM, ship's time.

Vessels in the China Sea send in plain-language reports to VPS Hong Kong at 0600 and 2200 GMT.

All ships on the northern trans-Pacific routes make a practice of exchanging weather reports at Noon and 8 PM, ship's time. About 95 per cent of the interference on the northern steamer routes is caused by ships asking for repetitions of these reports. By sending your own report ONCE and then keeping quiet it is possible to intercept dozens of these reports.

Remember that ships to the Eastward of you have their time ahead of yours and that their reports may be sent an hour or more before it is Noon or 8 PM with you.

Don't advertise yourself as a "dumbbell" by coming on watch too late and asking some other ship to repeat all the reports he has.

Operating Notes

All U. S. Pacific Coast commercial stations transmit on wavelengths between 675 and 735 meters. Unless otherwise mentioned, hereafter, all other stations use 600 meters.

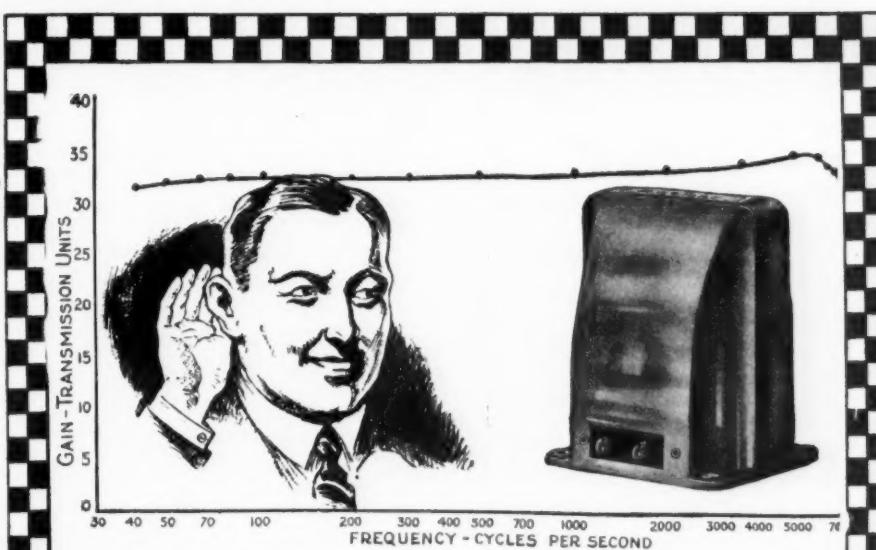
All Arc and CW equipped vessels on the Pacific listen for 2400 meter calls every even four hours, 4, 8 and 12 AM and PM.

KPH and KFS at San Francisco maintain continuous watch on 2400 meters.

KPE at Seattle listens for 2400 meter calls at 9 and 11 AM, and 1, 3, 5, 7 and 9 PM, P.S.T. Also listens on 2100 meters at 1 AM and 11 PM, P.S.T. Transmits on 2100 meters.

KHK at Waiawa, Hawaii is on 2400 meters continuously.

NPH at Hilo, Hawaii works 2400 meters at intervals.



"The human ear could not detect further tone improvement"

SCIENTISTS first told us this as Samson Symphonic Transformers were tested at famous universities and in the laboratories of well known radio engineers.

Users have called in musicians time and again only to have the scientists' finding told them all over again in slightly different words. The reason, in the form of a curve, is shown above. There you will see that audible music is amplified with remarkable evenness from the lowest to the highest frequency.

The frequency characteristics of the Symphonic transformer is more uniform than the average broadcast station or any loud speaker in common use today. Our book—"Audio Amplification"—already accepted as a manual of audio design by many radio engineers—contains much original information of greatest practical value to those interested in bettering the quality of their reproduction. Sent upon receipt of 25¢.

Those who desire to know how to get supreme coil efficiency can obtain our new "Inductance Units Bulletin" which will be sent on receipt of 10 cents to cover cost of mailing.

You will desire to know how to apply R.F. and A.F. Chokes to 17 popular circuits or your own receiver, as illustrated in our Make-'Em-Better Sheet. Send 5 cents to cover cost of mailing.

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1 1/4 mfd. 1000 volts rated
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is without comparison. To-day, as 15 years ago, Baldwin performance is the standard by which others are judged. The workmanship of this speaker is comparable to the sensitive mechanism of a fine watch. Can be used on any set.

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MILLER - WELLES CO.
18-H W. Kinzie St. Chicago

HOW TO TEST RADIOLA CATACOMBS

(Continued from page 35)

TABLE II—TEST SHEET FOR RADIOLA NO. 25 PANEL

BLACK In Socket Number	BASE Switch Contact Number	RED In Socket Number	BASE Switch Contact Number	CORRECT INDICATION	OTHERWISE TROUBLE AS INDICATED BELOW
1	G	2	G	Lights	Coil 13 open
1	G	2	P	None	Condenser 5 shorted
X1	P	6	P	Lights	Coil 1 or 7 open
1	P	6	1	None	Condenser 4 shorted
1	P	6	2	None	Condenser 3 shorted
1	2	6	G	None	Grid condenser shorted
X1	1	8	G	Lights	Coil 10 open
NOTE: On this test terminals 20 and 22 on rear of terminal strip must be shorted.					
2	P	3	P	Lights	Coil 3 or 14 open
2	P	4	P	Lights	Coil 3 or 5 open
2	G	4	G	Lights	Coil 2 or 4 open
2	G	5	G	Lights	Coil 12 open
2	P	5	P	Lights	Coil 3 or 11 open
X2	G	7	G	Lights	Coil 2 or 8 open
2	G	7	1	None	Condenser 2 shorted
X2	P	7	P	Lights	Coil 3 or 9 open
2	P	7	2	None	Condenser 1 shorted

TABLE III—RADIOLA 25 TESTING CATACOMB, AC EQUIPPED (OFF PANEL, BUT WITH RESISTANCE STRIP ON)

BLACK Switch Contact Number	SOCKET Socket Number	Testing Terminal to Whisker Number	CORRECT INDICATION	OTHERWISE TROUBLE AS INDICATED BELOW
P	1	13	Lights	Coil 3 or 5 open
P	1	7	None	Condenser 7 shorted
G	1	1	None	Condenser 1 shorted
G	1	7	Lights	Half of coil 1 open
G	2	5	Lights	Coil 4 open
G	3	10	Lights	Coil 6 open (thru resistance strip)
P	X3	15	Lights	Coil 7 or 11 open
P	3	3	Lights	Coil 7 or 2 open
P	4	10	None	Condenser 5 shorted
P	X4	12	Lights	Coil 9 open
G	4	10	(Very faint, if any, light)	Grid condenser shorted
G	X5	9	Lights	Coil 10 open
P	5	9	None	Condenser 3 shorted
G	X6	6	Lights	Coil 12 open
G	6	9	None	Condenser 4 shorted

X—indicates audio circuit

TABLE IV—RADIOLA NO. 28 CATACOMB, D.C. OPERATED

BLACK Switch Contact Number	SOCKET Socket Number	Testing Terminal to Whisker Number	CORRECT INDICATION	TROUBLE
P	1	9	Light	Coil 1 open
P	2	3	None	Condenser 5 shorted
P	2	10	Lights	Coil 3 open
G	2	3	Lights	1/2 of coil 2 open
G	4	8	Lights	Coil 4 open
P	4	10	Lights	Coil 5 open
P	4	16	Lights	Coil 5 or 9 open
P	6	9	Lights	Coil 7 open
G	6	1	None	Grid condenser shorted
1	6	9	None	Condenser 4 shorted
2	6	9	None	Condenser 3 shorted
2	6	13	None	Condenser 2 shorted
G	7	8	Lights	Coil 8 open
G	8	18	Lights	Coil 10 open

NORTH PACIFIC SCHEDULES (Continued from page 75)

Miscellaneous Notes

VAE's 1700 meter wave has a strong harmonic on approximately 500 meters up to about 2000 meters; the harmonic may be stronger than the true wave. NPO's 2650 meter wave has an exceptionally strong harmonic on 625 meters.

In the vicinity of Japan there is considerable interference on 2400 meters caused by harmonics from the high power station JAA at Iwaki, Japan.

Along the northern steamer routes RCD the spark station at Anadyr, Siberia, causes much interference on waves between 2000 and 2500 meters. RCD frequently kills KPH press. Between Hawaii and the Philippines there is much interference on 2400 meters from Japanese stations, Spk and CW, in the Caroline and Marshal Islands. Near the Philippines,

spark interference is bad from the Bureau of Posts' stations, especially from KPM at Iloilo who works on 2400 spark.

On an east-west line about 500 to 1000 miles northward of the Hawaiian Islands there is a spot where NPL, San Diego, fades very badly on 9800 meters.

"Singing" QRN is often encountered in the north Pacific, especially during rain, snow or sleet squalls. It will kill even the strongest of signals.

Unwritten Rules

Don't be a "Key Hound." Every time the transmitter is used it causes interference somewhere. Listen a few minutes before starting a call or make a Morse C (...) to be sure that things are clear.

Keep 600 meters clear for calls only. Send traffic on other waves. It is no heart-breaking task to shift wave.

Watch the clock and be sure you are not jamming 600 meter broadcast schedules before using the transmitter. One of the worst exhibitions in the radio world is the daily mess of interference at Pacific Coast Lightship weather schedule times.

On the trans-Pacific routes make it a point to keep off the air during the Noon and 8 PM weather exchange periods. Remember that ships East of you have their weather periods ahead of yours while ships to the west of you have theirs after you. Send your own report once and then keep quiet. Unnecessary sending during these periods may jam half a dozen reports for ships a thousand miles ahead or astern of you.

(To be continued)

The hundreds of radio operators all over the world who at some time or other attended Dodge's School at Valparaiso, Indiana, will be interested in knowing that their old friend, D. R. Clemons resigned his position as instructor on May 1. He has a splendid position with the Western Electric Company in their Chicago plant, being located in the special coils department. The work in this department comprises ways and methods for manufacturing all radio transformers, amplifier and carrier frequency transformers, and coils of all types pertaining to radio and carrier currents. We feel that Western is mighty lucky to get a man like D.R.C., at the same time feeling that the Dodge school lost one of the best instructors in the country. Mr. Clemons' thousands of friends join in wishing him great success in his new work. And now we will expect even greater things from Western!

* * *

We wonder how many ops could tell us what the calls "WKK" and "WTM" stand for right now without referring to their call books. One op wants to know if WMW (which is located on the seventh floor of a brewery) uses beverage wires. No, but they do have a bottle set.

* * *

When you have trouble trying to pick out one CW signal when another is almost on the same wave, try tuning to the other side of the dead spot. That is, heterodyne the signal on the other side of the spot where the receiver is oscillating at the same frequency as the incoming signal and no QRM is heard.

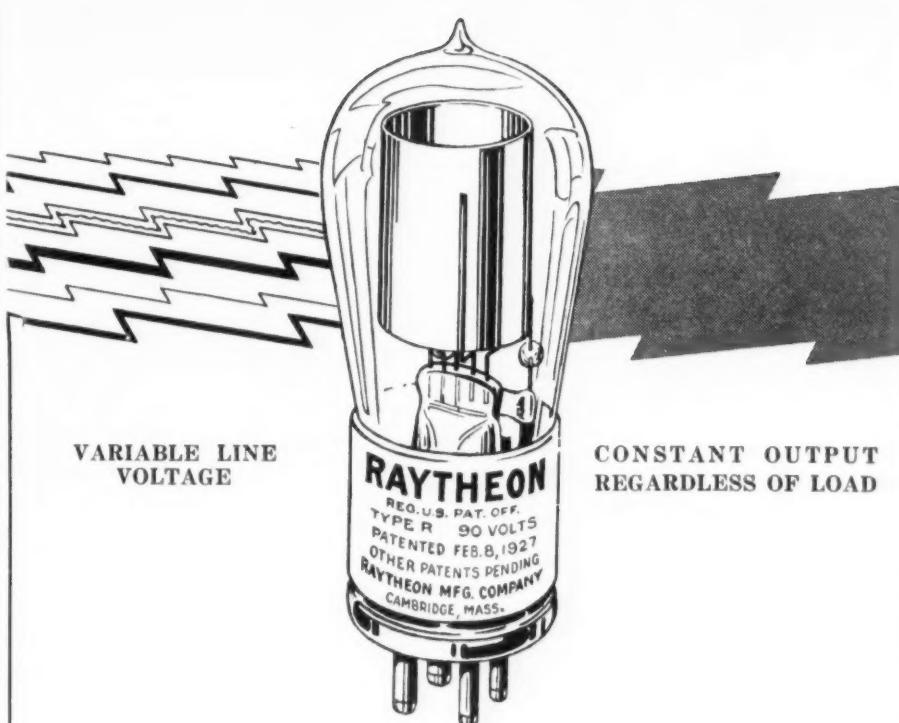
* * *

QSS?

All of us know how unhandy it is to dispose of matches after lighting our pipe or fag after we have settled into a comfortable position with our feet on the table. Why not put a copper screen half-way down the horn of your loud speaker—and try your aim? It's surprising how many matches it will hold before sige gets rather weak and has to be emptied.

Contributed by L. A. Zee.

P. S.—More to follow.



Raytheon Voltage Regulator Tube

EXPERIENCE gained in seven years of exhaustive research, experiments and tests, have enabled the Raytheon Research Laboratories to produce a new and fundamentally improved Voltage Regulator Tube of marked characteristics.

Raytheon—Type R, when incorporated in the proper B Power circuits, maintains constant voltage on the 90 and lower voltage taps and greatly improves the voltage regulation on the 180 and 135 volt taps, *regardless of variations in either the line voltage or load current*. The variable voltage controls can be thus eliminated and the construction of the unit simplified. Furthermore, this new tube has a very pronounced effect in eliminating the last vestige of ripple from the output, and when connected to an amplifier will completely eliminate "motor-boating."

A new feature—the starting anode—incorporated in type R, maintains constantly a state of ionization in the tube to prevent any "going out" regardless of the load fluctuation.

Raytheon—Type R, can be used in any power unit circuit now on the market employing a glow tube with greatly improved results. Diagrams of an approved Type R tube installation, in connection with the heavy duty Raytheon BH tube, can be had from the Raytheon Research Laboratories upon request.

Raytheon Type R, 90 volts, 60 milliamperes—Price \$4.00

Raytheon A—the compact, efficient rectifier, new in principle and construction.

For A battery chargers
and A battery eliminator units.

Raytheon BH—a 125 milliampere rectifying tube, because of its constant heavy duty output, is especially designed for use in conjunction with the Raytheon Type R Regulator Tube in light socket power units.

Raytheon BA—a 350 milliampere rectifying tube for complete battery elimination. Watch for the new ABC power units employing this rectifier.

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CAMBRIDGE, MASS.

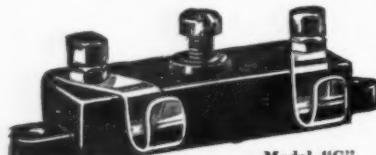
Raytheon

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VARIO DENSER

Easier tuning—correct tube oscillation—more volume and clearness with an X-L VARIO DENSER in your circuit. Specified and endorsed by foremost radio authorities in all leading circuits. MODEL "N"—Micrometer adjustment easily made, assures exact oscillation control in all tuned radio frequency circuits. Neutrodyne, Roberts two tube, Browning-Drake, Silver's Knock-out. Capacity range 1.8 to 20 micro-microfarads. Price \$1.00



Model "G"

MODEL "G"—Obtains the proper grid capacity on Cockaday circuits, filter and intermediate frequency tuning in superheterodyne and positive grid bias in all sets.

Capacity range:

Model G-1 .00002 to .0001 M. F. D.
Model G-5 .0001 to .0005 M. F. D.
Model G-10 .0003 to .001 M. F. D.
Price, each with grid clips \$1.50

X-L PUSH POST—Push it down with your thumb, insert wire, remove pressure and wire is firmly held. Vibrations will not loosen. Releases instantly. A push post that excels in appearance, action, service and convenience. Price each 15c



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X-L Push Post Panel

FREE—New, up-to-date book of wiring diagrams showing use of X-L units in the new LOFTIN-WHITE constant coupled radio frequency circuit, and in other popular hook-ups. WRITE TODAY!

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AMERICAN AUTO & RADIO MFG. CO.

HARRY SCHWARTZBERG, Pres.

Dept. 144 American Radio Bldg., Kansas City, Mo.

CAPACITY MICROPHONE

(Continued from Page 43)

oscillations. Tuning, with that adjustment, is quite unstable anywhere above about 1.6 m.a. A similar family of curves can be plotted by varying the mutual inductance with suitable fixed L_1 - L_2 coupling, and with a good vernier on C_2 , this might even be preferable for practical use.

weightless, while the resonance curve is a straight line along the short part used.

Four special types of vacuum tubes are available for use in the last stage of an audio frequency amplifier. Of these, the 120 type fits a small standard base and requires $\frac{1}{2}$ ampere at 3 volts for

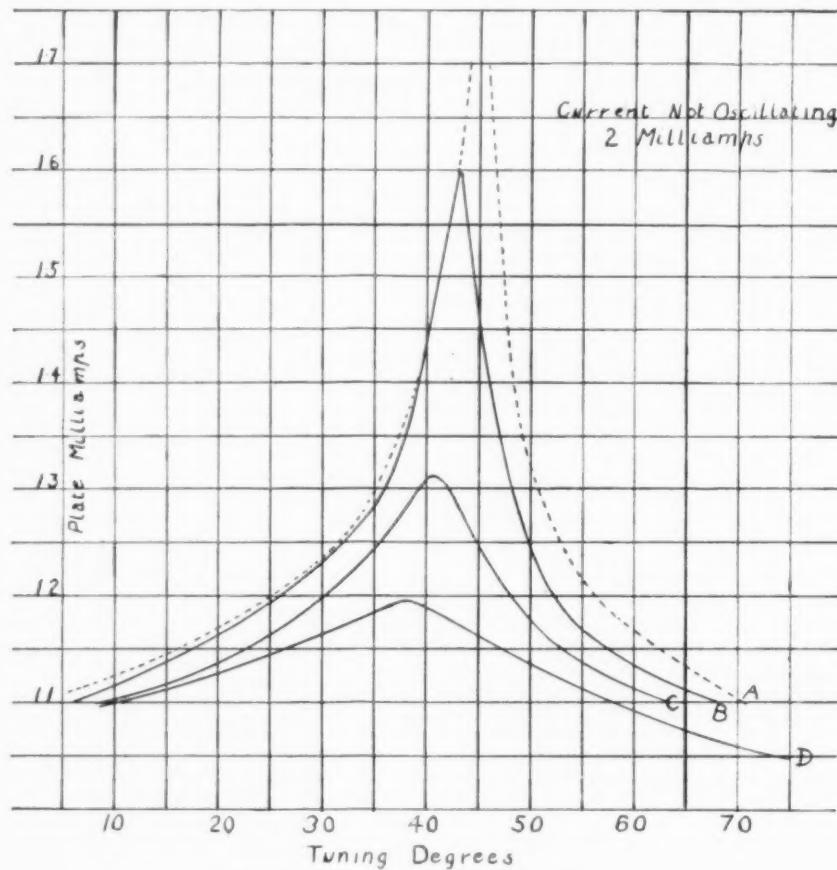


Fig. 2. Resonance Curves of Coupling.

To those who make this microphone it will be evident that it is by no means a finished piece of apparatus yet. The main difficulty is the need for accurate adjustments of the oscillator. There are several ways to eliminate that trouble. A very rigid construction may be used throughout, and a system provided for locking the tuning handle to the right adjustment; a high wave length may be used (the writer's set was tuned to 70 meters which is unnecessarily low); or the set may be used with an adjustment giving a very flat curve, such as D.

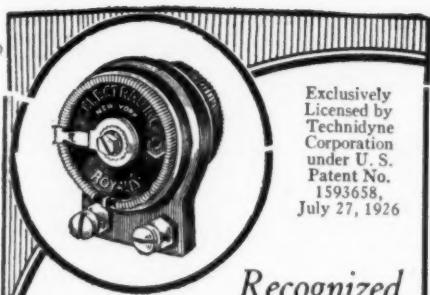
The obvious remedy is not to use such a circuit at all, but so far, that seems impossible. The usual capacity microphone circuit cannot be used because the fragile gold leaf won't stand the large electrostatic forces. However there is no reason why a modified design could not be developed which would provide some method of supporting the diaphragm.

Stronger diaphragms can be substituted for gold leaf but it has been found that while they change the sensitivity remarkably little, they have a serious effect on the reproduction. Even silver leaf is noticeably poorer than gold, in transmitting the sibilants.

There is plenty of room for interesting experimenting, though the microphone should be quite useful as it stands. For example its complete lack of audio resonance makes it useful in detecting resonance peaks in transformers or phones. Without an amplifier there is almost no possibility of distortion, for the diaphragm is to all intents and purposes

filament supply, and 6½ milliamperes at 135 volts for plate supply, the 112 and 171 types fit a large standard base and require $\frac{1}{2}$ ampere at 5 volts for filament supply with 7 milliamperes at 135 volts for the plate supply of the former and 20 milliamperes at 180 volts for the plate supply of the latter, and the 210 type fits a large standard base and requires 1½ amperes at 7½ volts for filament supply and 18 milliamperes at 425 volts for plate supply. The respective negative grid voltages at the plate voltages stated are 22½ volts for the 120, 9 volts for the 112, 40½ volts for the 171, and 35 volts for the 210 type. The amplification factors are 3.3 for the 120, 8 for the 112, 3 for the 171, and 8 for the 210 type.

The Nema standard for the normal output of a broadcast receiver is .05 watt. This is measured at the terminals of an output filter which allows only alternating current to pass into a non-inductive resistor used as a load. This resistor should be adjusted so as to give maximum output for normal adjustments of the vacuum tube used in the last stage of audio.



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1593658,
July 27, 1926

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Superior!

ELECTRAD Royalty Variable High Resistances

Specified by radio engineers and technicians where accurate and dependable resistances for all circuit work are desired. Note these superior features:

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A range for every purpose—11 in all. Type E—\$2.00. All other types \$1.50.

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AMENDED REGULATIONS GOVERNING THE ISSUANCE OF RADIO OPERATORS' LICENSES

(1) *Commercial extra first class.*—To be eligible for examination an applicant for this class of license must have held a commercial first-class license and must have been actually engaged as an operator at stations open to public correspondence for at least 18 months during the two years previous to his application.

A speed in transmission and reception of at least 30 words per minute, Continental Morse Code, and 25 words per minute, American Morse Code, five characters to the word, must be attained.

The questions in this examination will be considerably wider in scope than those used for commercial first-class licenses. A percentage of at least 80 will constitute a passing mark.

Holders of licenses of this class are authorized to operate any licensed radio station.

(2) *Commercial first class.*—Applicants for this class of license must pass a code test in transmission and reception at a speed of at least 20 words per minute in Continental Morse Code (five characters to the word).

The practical and theoretical examination shall consist of comprehensive questions under the following headings:

- (a) Experience.
- (b) Diagram of receiving and transmitting apparatus.
- (c) Transmitting apparatus.
- (d) Receiving apparatus.
- (e) Operation and care of storage batteries.
- (f) Motors and generators.
- (g) International Regulations governing radio communication, and the United States Radio Laws and Regulations.

A percentage of 75 will constitute a passing mark for this class of license.

Holders of this class of license are authorized to operate any licensed radio station.

(3) *Commercial second class.*—Applicants for this class of license must pass a code test in transmission and reception at a speed of at least 12 words per minute in Continental Morse Code (five characters to the word).

The practical and theoretical examination will cover the same subjects as required for the first-class license.

A percentage of 65 will constitute a passing mark.

Holders of this class of license are authorized to operate only licensed radio stations not open to general public correspondence. This fact should be indicated by having all licenses of this class bear across their face, preferably in red, the following restriction: "This license not valid for the operation of any general public service station."

Applicants desiring to operate broadcasting stations only will be given an examination pertaining specifically to broadcasting apparatus. The licenses so issued will indicate this limitation by showing across their face, preferably in red, the following restriction: "This license valid only for the operation of a broadcasting station."

(4) *Operator permits.*—In special cases where no interference with communications of other stations is involved, consideration will be given to applications for the operation of particular stations, without technical examination.

(5) *Amateur license.*—Applicants for this grade of license must pass a code test in transmission and reception at a speed of at least 10 words per minute in Continental Morse Code (five characters to the word).

An applicant must pass an examination which will develop knowledge of the adjustment and operation of the apparatus which he desires to use and of the international regulations and acts of Congress in so far as they relate to interference with other radio

Most
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"B"
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Built under exclusive patents on electro dynamic principle made famous by Magnavox. Recognized by technical experts and music critics as the one method of construction for perfect reproduction.



R-4 Unit

Type R-4 has 6 volt $\frac{1}{2}$ ampere field, list \$50. Type R-5, list \$55 for A. C. radio or phonograph circuits using field as the choke in filter pack. Unit designed for easy installation in radio and phonograph cabinets.



Beverly Cabinet

Beverly cabinet speaker complete with R-4 unit, cords, switch \$75. Requires 6 volt A battery for power supply.



R-50 Unit

Type R-51 unit is R-5 with built-in power amplifier and rectifier using one 216 and one 210 tube. List \$120. Easily installed in your radio or phonograph cabinet.



Loboy Cabinet

Loboy cabinet speaker, complete with R-51 unit, cords, etc., \$165.

Order through nearest dealer or write us for special bulletin about electro dynamic and permanent magnet type speaker units.

THE MAGNAVOX CO.

Oakland, California

Chicago Sales Office 1315 So. Michigan Ave.

communications and impose duties on all classes of operators.

A percentage of 70 will constitute a passing mark.

This license is valid for the operation of licensed amateur radio stations only.

(6) *Temporary Amateur License.* — Amateurs who can not be examined at time of application may be given temporary licenses valid for the operation of a particular station until such time as examination for a regular license can be held, but not to exceed a period of one year.

(7) *Renewals.* — 1. Commercial extra first class: These licenses may be renewed without examination, provided the record shows 12 months' satisfactory service in a land or ship station open to general public service, at least 6 months of which must have been during the last 12 months of the license period. Holders of these licenses employed as radio inspectors, radio instructors, or in similar occupations requiring exceptional qualifications where the duties require the testing, or demonstrating, or otherwise using commercial radio apparatus and the telegraph codes may be issued renewals of their licenses without examination, provided such employment has covered a period of 18 months out of the two-year license period. Where the applicant has not regularly used the telegraph codes he will be given the code examination as for an original license, and if he has used only one code, he will be examined in the code not used.

2. Other renewals: Renewal licenses may be issued to operators of other classes without examination, provided the operator has had three months' satisfactory service during the last six months of the license term. One year satisfactory service out of two years of the license term may be accepted for renewal at the discretion of the examining officer.

3. Holders of commercial first-class radio operator licenses who have not had sufficient service at commercial stations to permit the unconditional renewal of such licenses, but indicate satisfactory service at broadcasting stations for the length of time necessary for renewal and are unable to pass the required code test or to present themselves for a code test, may be issued restricted renewals of their existing licenses. The licenses so issued should bear across their face, preferably in red, the following restriction: "This license not valid for the operation of any limited or general public service station."

Holders of commercial second-class radio operator license who have passed the regular commercial second-class examination but have not had sufficient service at stations regularly using the Continental Code to permit unconditional renewal of such licenses, but indicate satisfactory service at broadcasting stations for the length of time necessary for renewal but are unable to pass the required code test or to present themselves for a code test may be issued restricted renewals of their existing licenses. The licenses so issued should bear across their face, preferably in red, the following restriction: "This license not valid for the operation of any limited or general public service station."

Applicants holding restricted commercial operators' licenses or broadcast operators' licenses may be issued renewals of such licenses provided the service records indicate three months' satisfactory service during the last six months of the license term. One year satisfactory service out of the two-year term of the license may be accepted at the discretion of the examining officer. Renewal commercial-class licenses so issued shall bear the indorsement "This license not valid for the operation of any limited or general public station," and renewal broadcast licenses should bear the indorsement "Valid only for the operation of a broadcasting station."

Applicants who have passed the regular

AT LAST—

Control of Radio Reception
from Your Easy Chair!



Turn set on and off—get station after station—swifly—surely—DX—without leaving your easy chair.

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REMOTE CONTROL
RADIO TUNING UNIT

No other tuning unit in the world like it. Tune your set from any room of your home. Attached to any single dial receiver with removable dial in a few minutes by removing old dial and attaching adapter plate with Remote Control Unit. Mechanical Model... \$18 Electrical Model... 60 West of Rockies, add 10 per cent. Write today for circular describing radio's newest and most revolutionary development.

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Type 200A	4.00
POWER TUBES	
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commercial examination, but who hold renewal licenses indorsed "This license is not valid for the operation of any limited or general public service station," may be issued unconditional renewals of such licenses provided that they have the required service as indicated above and pass the code test required by the regulations for the class of license held by them.

(8) *Re-examination.* — No applicant who fails to qualify will be re-examined within three months from date of the previous examination. All examination papers, except amateur, whether the applicant qualifies or not, will be forwarded to the Department of Commerce, Radio Division, for filing.

Harry Pearce, amateur 6DDO, has been keeping a skip with Karl Zint, op on Zane Grey's yacht "Fisherman" ever since the latter left for the South Sea Islands. The salty suds of KNT got under Pearce's skin, in the usual way, and now we find him aboard the S. S. *Wm. T. Rossell*, WYCQ, headed for the Panama Canal, thence to Florida. As the call indicates the Rossell is in the Army Engineering Department. Harry is going to see if the Ikw. Navy standard can out-push his fifty watt 40 meter job. It will have to work Mars to do it.

HOW TO SERVICE THE INSTALLED SET

By B. F. McNAMEE

(Continued from Page 26)

The selectivity of single circuit receivers can be improved by the addition of two fixed condensers as shown in Fig. 2. Some advantages of this arrangement are its low cost and the fact that no

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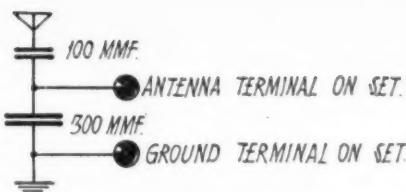


Fig. 2. Circuit for Improving Selectivity.

changes are made within the set. It also greatly minimizes the radiation from oscillating receivers, and was designed for this purpose by C. C. Lauritsen and the writer. The capacities may be changed to suit the set.

When the set is inherently non-selective, it is unwise for the service man to try to alter the circuits inside of the set where it is installed. This is properly a shop or laboratory job for an expert workman.

Loss of selectivity in a single control receiver may be due to improperly tuned r.f. stages. A trimmer may have no effect on weak signals or may have to be turned to the extreme. The correction of this trouble requires special equipment and methods as described on page 29 of September, 1927, RADIO.

Short "B" battery life may be due to a leaky by-pass condenser (see last test in Continuity Test Table). Another simple test is to connect the voltmeter in the —B lead; that is, connect the meter negative to the negative of the —B battery, and the meter positive to the —B terminal or cable from the set. In this way all B battery current must flow through the meter. Shut off the filaments, and the meter should read zero. Any reading of the meter indicates current leakage.



No matter whether you want to improve a set you now have or build a new one — get this book first. Tells how to build the latest one, two and three dial receivers — 5 to 7 tubes.

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GEARHART-SCHLUETER, Fresno, Cal.

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A. C.
Tube
AND
Kit

ADVANCED 1928 Model Sovereign A-C Kit

No more A Battery—No A Battery Eliminator—No Hum—No Microphonic Disturbance—Just Clear, Clean Cut, Truthful Reproduction—powered from the never failing light socket by the mere snap of the switch. CONVERT YOUR PRESENT RECEIVER TO 1928 STANDARDS WITH THE ADVANCED 1928 MODEL SOVEREIGN A. C. KIT—With but slight modifications, easily accomplished by following the detailed instructions supplied in each Sovereign A. C. Kit ANY CIRCUIT becomes a light socket powered receiver. You need not be a Radio Engineer—or master "radiotrician" to construct an A. C. Receiver or convert your present set. Just follow the very simple, definite, detailed instructions given FREE with Sovereign Equipment. That's all!

When you purchase Sovereign Products you have the knowledge that nothing in the radio industry today carries greater assurance of proper design—construction—satisfaction or guarantee.

Sovereign A. C. Tubes acknowledged the "Crowning Achievement" in the Radio Tube field are unconditionally guaranteed. They have a more rugged construction—a longer life! Sovereign A. C. Tubes improve tonal quality as they are non-microphonic and fit all standard sockets. Summing it all in a few words, Sovereign Equipment means ECONOMY—EFFICIENCY—MINIMUM SERVICING—THE IDEAL IN RADIO RECEPTION.

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SOVEREIGN A. C. KIT—110 or 220 volts, 25 cycles..... Price \$9.75
In ordering Kits specify voltage of house current—No. of cycles—Type of circuit—No. of tubes.

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 1 No. 1810 De Luxe 10-ohm Bakelite Rheostat, gold arrow knob.
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 4 No. 253 Frost-Radio Cord Tip jacks.
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CANADIAN BROADCAST STATIONS

Call signal	Owner of station	Location of station	Wave length (meters)	Frequency (kilocycles)	Power input to antenna (watts)
CFAC	The Calgary Herald	Herald Building, Calgary, Alberta	434.5	690	500
CFCA	Star Publishing & Printing Co.	Southwest corner Yonge St. and St. Clair Avenue, Toronto, Ontario	356.9	840	500
CFCF	Canadian Marconi Co.	Mount Royal Hotel, Montreal, Quebec	410.7	730	1,650
CFCH	Abitibi Power & Paper Co. (Ltd.)	Iroquois Falls, Ontario	499.7	600	250
CFCN	W. W. Grant (Ltd.)	708 Crescent Road NW, Calgary, Alberta	434.5	690	500
CFCQ	Sprott-Shaw Radio Co.	Room 1604, Bekin Building, Vancouver, B. C.	410.7	730	1,800
CFCT	G. W. Deaville	1405 Douglas Street, Victoria, British Columbia	329.5	910	10
CFCY	The Island Radio Co.	176 Kent Street, Charlottetown, Prince Edward Is.	312.9	960	10
CFGC	The Brandt Radio Supply Co. (Ltd.)	90-96 Colborne Street, Arcade Building, Brantford, Ontario	296.9	1,010	50
CFJC	N. S. Dalgleish & Sons and Weller & Weller	186 Victoria Street, Kamloops, British Columbia	267.7	1,120	15
CFLC	Radio Association of Prescott	Victoria Hall, Prescott Ontario	296.9	1,010	50
CFMC	Monarch Battery Co.	Montreal Street, Kingston, Ontario	267.7	1,120	20
CFNB	James S. Neill & Sons (Ltd.)	212 Waterloo Row, Fredericton, New Brunswick	247.8	1,210	25
CFQC	The Electric Shop (Ltd.)	1322 Osler Street, Saskatoon, Saskatchewan	329.5	910	500
CFRB	Standard Radio Manufacturing Corporation (Ltd.)	Lot 70, township of King, York County, Ontario	291.1	1,030	1,000
CFRC	Queen's University (Department of Electrical Engineering)	Fleming Hall, Queen's University, Kingston, Ontario	267.7	1,120	500
CFYC	International Bible Students Association	2243 Royal Oak Avenue, Burnaby, British Columbia	410.7	730	500
CHCS	The Hamilton Spectator	Spectator Building, Hamilton, Ontario	340.7	880	10
CHCY	International Bible Students Association	Lots 19-22, block 46, King Edward Park, Edmonton, Alberta	516.9	580	250
CHGS	R. T. Holman (Ltd.)	Holman Building, Summerside, Prince Edward Is.	267.7	1,120	25
CHIC	Northern Electric Co. (Ltd.), (uses Station CKNC, Canadian National Carbon Co., Toronto, Ontario)	Hillcrest Park, Toronto, Ontario	356.9	840	500
CHMA	Christian & Missionary Alliance	9618-106A Avenue, Edmonton, Alberta	516.9	580	250
CHNC	Toronto Radio Research Society (uses Station CKNC, Canadian National Carbon Co., Toronto, Ontario)	Hillcrest Park, Toronto, Ontario	356.9	840	500
CHNS	Northern Electric Co. (Ltd.)	Carleton Hotel, corner Prince and Argyle Streets, Halifax, Nova Scotia	322.4	930	100
CHPC	Central Presbyterian Church (uses Station CKCD, Vancouver Daily Province, Vancouver, British Columbia)	Vancouver, British Columbia	410.7	730	1,000
CHRC	E. Fontaine	120 Dolbeau Street, Quebec, Quebec	340.7	880	5
CHSC	H. N. Stovin and Radio Sales	Main Street, Unity, Saskatchewan	267.7	1,120	50
CHUC	International Bible Students Association	Corner Avenue D and Twenty-sixth Street, Saskatoon, Saskatchewan	329.5	910	500
CHWC	R. H. Williams & Sons (Ltd.)	Corner Hamilton Street and Eleventh Avenue, Regina, Saskatchewan	312.3	960	15
CHYC	Northern Electric Co. (Ltd.)	121 Shearer Street, Montreal, Quebec	410.7	730	750
CJBC	Jarvis Street Baptist Church (uses one of the stations in Toronto city or district)	Toronto, Ontario	291.1	1,030	500
CJBR	Saskatchewan Co-operative Wheat Producers (Ltd.), (uses Station CKCK, Leader Publishing Co. (Ltd.), Regina, Saskatchewan)	Regina, Saskatchewan	312.3	960	500
CJCA	The Edmonton Journal (Ltd.)	Journal Building, Edmonton, Alberta	516.9	580	500
CJCJ	Radio Service & Repair Shop	Eighteenth Avenue and Seventh St. E., Calgary, Alta.	434.5	690	250
CJCU	E. R. Streeter	Washington and James Sts., Mission City, British Columbia	247.8	1,210	5
CJGC	London Free Press Printing Co. (Ltd.)	430 Richmond St., London, Ontario	329.5	910	500
CJGX	The Winnipeg Grain Exchange	Yorkton, Saskatchewan	475.9	630	500
CJOR	G. C. Chandler	Block 20, Sea Island, British Columbia	291.1	1,030	50
CJRM	Jas. Richardson & Sons (Ltd.)	337 Coteau Street, W., Moose Jaw, Saskatchewan	296.9	1,010	50
CJSC	The Evening Telegram (uses Station CKCL, The Dominion Battery Co. (Ltd.), Toronto, Ontario)	Toronto, Ontario	356.9	840	500
CJWC	Wheaton Electric Company (Ltd.)	Thirty-third Street and Avenue C north, Saskatoon, Saskatchewan	329.5	910	250

Tell them that you saw it in RADIO

Call signal	Owner of station	Location of station	Wave length (meters)	Frequency (kilocycles)	Power input to antenna (watts)
CJYC	Universal Radio of Canada (Ltd.)	Scarboro Station, Ontario	291.1	1,030	500
CKAC	La Presse Publishing Co. (Ltd.)	Corner St. James Street and St. Lawrence Boulevard, Montreal, Quebec	410.7	730	1,200
CKCD	Vancouver Daily Province	142 Hastings Street, west, Vancouver, B. C.	410.7	730	1,000
CKCI	Le "Soleil" (Ltd.)	120 Dolbeau Street, Quebec, Quebec	340.7	880	22½
CKCK	Leader Publishing Co. (Ltd.)	Regina, Saskatchewan	312.3	960	500
CKCL	The Dominion Battery Co. (Ltd.)	20 Trinity Street, Toronto, Ontario	356.9	840	500
CKCO	Dr. G. M. Geldert (for Ottawa Radio Association)	282 Somerset Street, west, Ottawa, Ontario	434.5	690	100
CKCV	G. A. Vandry	66 St. Joseph Street, Quebec, Quebec	340.7	880	50
CKCW	Gooderham & Worts (under construction)	Bowmanville, Ontario	312.3	960	5,000
CKCX	International Bible Students Association of Canada (uses Station CJYC, Universal Radio of Canada (Ltd.), Scarboro Station, Ontario)	Scarboro Station Ontario	291.1	1,030	500
CKFC	United Church of Canada	Corner Thurlow and Pendrell Streets, Vancouver, British Columbia	410.7	730	50
CKLC	Alberta Pacific Grain Co. (Ltd.)	Red Deer, Alberta	356.9	840	1,000
CKMC	R. L. MacAdam	Cobalt (east side), Ontario	247.8	1,210	5
CKNC	Canadian National Carbon Co. (Ltd.)	Hillcrest Park, Toronto, Ontario	356.9	840	500
CKOC	Wentworth Radio Supply Co. (Ltd.)	Royal Connaught Hotel, Hamilton, Ontario	340.7	880	50
CKPC	Wallace Russ	40 Russ Avenue, Eagle Street, Preston, Ontario	247.8	1,210	7½
CKPR	E. O. Swan	Midland, Ontario	267.7	1,120	50
CKSH	City of St. Hyacinthe, Quebec	Mondor and Cascades Streets, St. Hyacinthe, Quebec	312.3	960	50
CKSM	St. Michael's Cathedral (uses Station CFRB, Standard Radio Manufacturing Corporation (Ltd.), Toronto, Ontario)	Toronto, Ontario	291.1	1,030	1,000
CKUA	University of Alberta	Campus, University of Alberta, Edmonton, Alberta	516.9	580	500
CKWX	A. Holstead and Wm. Hanlon	1006 Granville Street, Vancouver, British Columbia	410.7	730	10
CKY	Manitoba Telephone System	Sherbrooke Street, Winnipeg, Manitoba	384.4	780	500
CNRA	Canadian National Railways	Moncton, New Brunswick	322.4	930	500
CNRC	Canadian National Railways (uses Station CFAC, Calgary Herald, Calgary, or uses Station CFCN, W. W. Grant (Ltd.), Calgary)	Calgary, Alberta	434.5	690	500
CNRE	Canadian National Railways (uses Station CJCA, Edmonton Journal (Ltd.), Edmonton, Alberta)	Edmonton, Alberta	516.9	580	500
CNRM	Canadian National Railways (uses Station CHYC, Northern Electric Co. (Ltd.), or uses Station CKAC, La Presse Publishing Co. (Ltd.), or uses Station CFCF, Canadian Marconi Co., Montreal, Quebec)	Montreal, Quebec	410.7	730	1,000-1,650
CNRO	Canadian National Railways	Ottawa, Ontario	434.5	690	500
CNRQ	Canadian National Railways (uses Station CKCV, G. A. Vandry, Quebec, Quebec)	Quebec, Quebec	340.7	880	50
CNRR	Canadian National Railways (uses Station CKCK, Leader Publishing Co. (Ltd.), Regina, Saskatchewan)	Regina, Saskatchewan	312.3	960	500
CNRS	Canadian National Railways (uses Station CFCQ, Electric Shop, (Ltd.), Saskatoon, Saskatchewan)	Saskatoon, Saskatchewan	329.5	910	500
CNRT	Canadian National Railways (uses Station CFCA, Star Printing & Publishing Co., Toronto, Ontario)	Toronto, Ontario	356.9	840	500
CNRV	Canadian National Railways	Vancouver, British Columbia (Lulu Island)	291.1	1,030	500
CNRW	Canadian National Railways (uses Station CKY, Manitoba Telephone System, Winnipeg, Manitoba)	Winnipeg, Manitoba	384.4	780	500

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Automatic Power Control

Here is just another reason why Yaxley Approved Radio Products are so popular with the radio fans. A new and better Automatic Power Control that does all the extra switching for you in a sure and positive way. Cuts in the B eliminator and cuts out the trickle charger when the set is turned on; cuts in the trickle charger and cuts out the B eliminator when the set is turned off. No. 444-Series Type. Now furnished with new construction, exclusively Yaxley that keeps the voltage drop less than two-tenths (2/10) volts when used with sets having a current draw equivalent to four 199-type of tubes up to eleven 201-type of tubes.

Cable Connector Plug

\$5.00



Preserve the neat appearance of your set by centering all battery wires in one neat compact cable. The Yaxley Cable Connector Plug does this in a simple and efficient way. Plug is of Bakelite construction with contact springs of phosphor bronze—a positive contact assured at all times.

No. 660—Cable Connector Plug, Complete \$3.00

No. 670—Cable Connector Plug, for Binding Post Connections, Complete \$3.50

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Rated to carry 60 watts continuous duty

1100 ohms with taps of 400, 400 and 300 ohms
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**EXTRA SPECIAL PRICE OF
85 CENTS EACH**

All of these Ward Leonard Heavy Duty, Vitrohm (vitreous enamel) Resistors are brand new. Size 4x1 in. They are absolutely permanent and accurate in value and are for use in your Eliminator, Transmitter and all kinds of electrical control work.

AMERICAN SALES CO., 21 WARREN STREET, NEW YORK CITY

SCRATCHI CLEARS THE AIR

Dear Sir Ed:

Since last time I write at you, which are now round about two years ago past away, several changes have occurred themselves in the radio games. Might be you have learned about this yourself also, but I would inform you how the most late developments have hit at me since my returning back here.

In the meantime I have paid longish visit to home land in Nagasaki where I engage myself in radio casting bizness with less than more success. During first year after putting my station J.O.K.E. on Japanese ether I do most charming volume of turn over, and shoestring I started with become amplified to bundle of long green, because large number of bizness people are tickled pinkish to place themself in favorable spots light before listening millions, if any. But after a few bits my cash-paying customer firms fall off with many dull thuds, as they find out that listeners whose loud horns erupt almost nothing but ad for soap and hams and Majong games, do not receive same with very joyful expressions. Jap person are too smart to keep buying bird in bag, and he like better to have pig in hand than two in the bushes.

So, Mr. Ed, when the filthy looker no longer arrive in necessary amounts I decide it are time for all good men to parade away from the party before party become utter flop. I catch maru boat at far end of dock just two hops skips to the front of Japanese sheriff who wave large handful of bills which I do not at all require. And so, after three bounding weeks on the sometimes Pacific Ocean, I am delightful to be back again in the land of the free and easy speakeys.

First homely face I shake hands with when maru boat heave herself up to dock here are my Cousin Scratchi. After various minutes of bowings and "Howdy do, please?" Scratchi scorted me to large wealthy looking auto and drive me along to his radio store in the outer skirts of the city. Here for few days past I have been digging the low down up and twisting the inside dope out to find what present condition of radio are all about.

"Can you tell me something?" I put question mark at my Cousin Scratchi, "Give me some expert advising on up-to-the-moment radio."

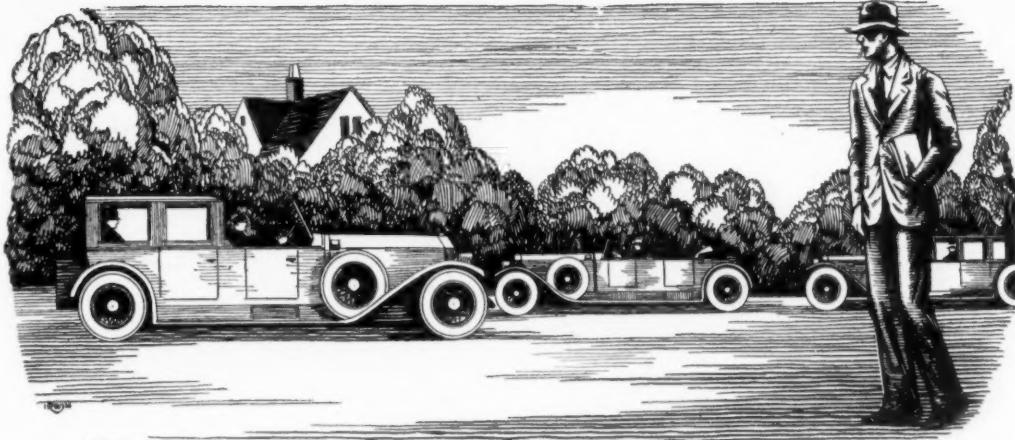
"That are too easy," response of Scratchi, "because everybody in radio are a expert."

"I are no expert," I cross word back at him vertically.

"If not," he puts horizontally, "you are lonesomer than single flea on poodle dog."

"How does it come around," I slip

(Continued on page 86)



Many times in the old days, while I trudged home after work to save carfare, I used to gaze enviously at the shining cars gliding by me, the prosperous men and women within. Little did I think that *INSIDE OF A YEAR*, I, too, should have my own car, a decent bank account, the good things of life that make it worth living.

I Thought Success Was For Others

*Believe It Or Not, Just Twelve Months Ago
I Was Next Thing To "Down-and-Out"*

TODAY I'm sole owner of the fastest-growing Radio store in town. And I'm on good terms with my banker, too—not like the old days only a year ago, when often I didn't have one dollar to knock against another in my pocket. My wife and I live in the snuggest little home you ever saw, right in one of the best neighborhoods. And to think that a year ago I used to dodge the landlady when she came to collect the rent for the little bedroom I called "home"!

It seems like a dream now, as I look back over the past twelve short months, and think how discouraged I was then, at the "end of a blind alley." I thought I never had had a good chance in my life, and I thought I never would have one. But it was waking up that I needed, and here's the story of how I got it.

I WAS a clerk, working at the usual miserable salary such jobs pay. Somehow I'd never found any way to get into a line where I could make good money.

Other fellows seemed to find opportunities. But—much as I wanted the good things that go with success and a decent income—all the really well-paid vacancies I ever heard of seemed to be out of my line, to call for some kind of knowledge I didn't have.

And I wanted to get married. A fine situation, wasn't it? Mary would have agreed to try it—but it wouldn't have been fair to her.

Mary had told me, "You can't get ahead where you are. Why don't you get into another line of work, somewhere that you can advance?"

"That's fine, Mary," I replied, "but what line? I've always got my eyes open for a better job, but I never seem to hear of a really good job that I can handle." Mary didn't seem to be satisfied with the answer but I didn't know what else to tell her.

It was on the way home that night that I stopped off in the neighborhood drug store, where I overheard a scrap of conversation about myself—a few burning words that were the cause of the turning point in my life!

With a hot flush of shame I turned and left the store, and walked rapidly home. So that was what my neighbors—the people who knew me best—really thought of me!

"Bargain counter sheik—look how that suit fits," one fellow had said in a low voice. "Bet

he hasn't got a dollar in those pockets." "Oh, it's just 'Useless' Anderson," said another. "He's got a wish-bone where his back-bone ought to be."

As I thought over the words in deep humiliation, a sudden thought made me catch my breath. Why had Mary been so dissatisfied with my answer that "I hadn't had a chance"? *Did Mary secretly think that too?* And after all, wasn't it *true* that I had a "wish-bone" where my back-bone ought to be? Was that why I never had a "chance" to get ahead? It was true, only too true—and it had taken this cruel blow to my self-esteem to make me see it.

With a new determination I thumbed the pages of a magazine on the table, searching for an advertisement that I'd seen many times but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

WHAT'S happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months, *I've had a Radio business of my own!* At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance!"

NOW I'm making real money. I drive a good-looking car of my own. Mary and I don't own the house in full yet, but I've made a substantial down payment, and I'm not straining myself any to meet the installments.

Here's a real tip. You may not be as bad-off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be doing something about it instead of drifting.

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well-paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. MB-5, Washington, D. C.

J. E. Smith, President,
National Radio Institute,
Dept. MB-5, Washington, D. C.

Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

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(Continued from page 84)

over at him, "that you have picked up so expansive radio knowledge in short two year period?"

"I have not stooped over to pick up any such," hand back Scratchi loftily, "because knowledge of what are inside of radio set are not conducive to selling radio sets to generally public. It are indeed a handy cap," he add on.

"What are most important pointer then?" I ask him another.

"The point where you can grab up pretty appearing cabinet at lowest price for spotty cash," my cousin riddle me back.

"But what are to be done with this slickly-seeming cabinet?" I peep. "Do not insides cost highly?"

"Ah, that are comicle pointer," he pop back. "The public which are at large pay rising price costs according to number of tubes inside of cabinet, but I can add 4 or 6 tubes to old three tube internal part for about 1 1/4 dollars, while buyer gladly cough out \$20 more for a six-tuber than for a five-tuber, and \$50 more for a 8 or a 9."

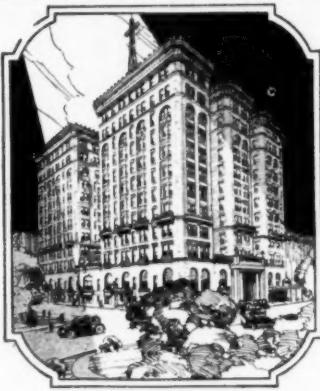
"But are not there grand difference in the circuits and results of each group?" I fire point blank.

"Try and find it," Scratchie slang at me.

And I do, Mr. Ed. I try all the evening with every set my cousin have in his place which are many. Slobodynes, Nobodynes and Razziolas, Hotwater Cans and Brown - Ducks, Magnum boxes and Crossed Band boxes, and 7 or 11 more with names like grecy restaurant owners—I try them one by each. I try them on DX, on PX and on X plus Y squared. I try them on fast frequently, on slow frequently and frequently both. I try them on Cone speakers, on Bone speakers and Groan speakers; on floater cones, flyer cones and on roly-poly cones. I try them on buried antennas and resurrected earths; on balled up aerials and on coiled up grounds. I try them with 1 or 2 dozen of sorted eliminators which all make sneaky attempt to eliminate the A, B, C and D batts by con-sealing small samples of same inside of several tin cans. I try them with all possible and many impossible types of tubes, AC tubes, DC tubes and BC tubes; moonshine tubes and garanteed pre-war tubes. I try them with Billard batteries and Poole tables; with Drum dials, Bum dials and very near dials. And what, Mr. Ed, are final last output of these testy examinations? I repeat "What?"

Echo answer "Which?"

To the naked ear, Ed, difference between all and any of these setups are less than 1/2 of 1 percent, which are non-spifflckating, if that are correct expression. It are smaller than a young electron, and you know this are really very midget affair. Nobody but high priced professor with handfuls of curves,



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giraphs and diegrams can pass judgment out on what are good fit-out and what are mere bunkadoodle.

So I chase up my Cousin Scratchi and I puzzle at him like these:

"How can you sell," I dib at him, "so many species of radio sets at varied money cost if difference between each are so very non-existing?"

"By simple sell-out plan," he glib back, "I buy up lot of deadly stock of sets for 3½ dollars each, mark them up to 75 dollars and on weekly fire sale I mark them down again to 49 dollars and 98 cents. Customer who think he are driving smartly bargain are quite satisfied, I am getting ready for grand super special aniversity sale and am quite satisfied. Are you?" he flip.

I are unable to respond anything but "Yes," Mr. Ed, and I hope you are likewise the same as I am,

Yours radiantly,

HILOLI NOGO.

RADIO AMPLIFICATION

(Continued from Page 21)

Inferno were read from some broadcasting station.

The slightest suggestion of ill will is likely to become stifling rage. Expressions of good will are quite likely to be magnified into the highest kind of benevolence. The radio would be a God-send for timid lovers if the Federal Radio Commission would only permit it to be used for this purpose. The young man who is tongue-tied and ashamed in the presence of his beloved could thrill her with radio messages that would make Don Juan's tactics look like a penny valentine in comparison, and do it with only the slightest effort on his part. Just the hint of passion in his voice would be so amplified she would be his forever.

But taking it on the whole, the disadvantages outweigh the advantages, and the large radio companies are now working on filtering systems which will keep the stream of words and music from the studios absolutely pure from microphone to ear. It is hoped that inexpensive gadgets for this purpose will soon be available.

The Nema standard antenna used to test a broadcast receiver has in series a resistance of 25 ohms, a capacity of 200 micromicrofarads and a self inductance of 20 microhenries. In computing the radio field intensity of an impressed signal, the effective height of the antenna is to be taken as 4 meters—that is, the radio field intensity (in microvolts per meter) is equal to the impressed radio frequency voltage (in microvolts) divided by 4.

Tell them that you saw it in RADIO

RADIOADS

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The rate per word is eight cents net. Remittance must accompany all advertisements. Include name and address when counting words.

Ads for the November Issue Must Reach Us by October Fifth

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DOUGHNUT COILS Brand New—high grade coils, \$1.00, each, or \$3.00 per set of three, which includes 1 antenna coil and two tuning units. Limited number; order quickly. D. B. McGowen, 435 Pacific Bldg., San Francisco, Cal.

"BEST CRYSTAL ON EARTH" — Postpaid, fifty cents each. Fully Guaranteed. Harry Grant, Jr., 904 Oak Grove Ave., Burlingame, Calif.

SET BUILDERS—Substantial discounts on parts for the new 1928 INFRADYNE are allowed to those who specialize in home-built sets. Write now for complete illustrated circulars. RADIO CONSTRUCTORS CORPORATION, 337 Twelfth St., Oakland, California.

RADIO AGENTS—Make Big Money—Easy! Selling Marvelous New Sets and accessories. Buy from factory at lowest prices. Get New Catalog with thousands of nationally advertised bargains. FREE Call Book. Write today. American Auto and Radio Co., Dept. 148, American Radio Bldg., Kansas City, Mo. (3T)

MOTOR GENERATORS—Generators and motor-generators of various sizes, suitable for radio service on hand. New and second hand. Dynamos, 500 cycle alternators, separately excited and self-excited in all sizes from ¼ K.W. to 5 K.W. Prices reasonable. Special machines built up to order. Several machines with gas-engine drive; fine for portable service. Write for prices and full particulars. D. B. McGowen, 435 Pacific Bldg., San Francisco, Cal.

PRESS AND PUBLIC concede it to be the best ever produced. "Radio Theory and Operating" by Mary Texanna Loomis, member Institute of Radio Engineers, lecturer on theory of radio, Loomis Radio College. Thorough text and reference book; 886 pages, 700 illustrations, handsome, flexible binding. Price \$3.50, postage paid. Used by Radio Schools, Technical Colleges, Universities, Government Schools, Department of Commerce and Engineers. At bookdealers, or sent on receipt of check or money order to Loomis Publishing Company, Dept. X, 405 9th St., Washington, D. C.

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Ask Your Dealer

Reliable dealers have or will get genuine G. R. P. 3 foot DOUBLE Cone Speaker Kits. Ask your dealer. If he hasn't them, and will not get them for you, we will supply you direct, f.o.b. New York City on receipt of price. You need not accept inferior substitutes.

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From these parts you can assemble the finest speaker to which you ever have listened—a speaker which will deliver absolutely accurately every frequency passed to it from the highest to the very lowest.

All—absolutely all—of the parts needed to build the G. R. P. 3 foot DOUBLE Cone Speaker are included in one kit: decorated front cone of genuine Fonotex; accurately marked sheet genuine Fonotex for back cone; G. R. P. Back Ring (pat. pending); G. R. P. Cone Speaker unit; G. R. P. Unit Mountings; G. R. P. Cone Apex Assembly; edging braid; rubber bumpers, bolts, nuts, washers, screws—absolutely everything. All in one kit. Price

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